



FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 2, 87, and 90

[ET Docket No. 13-115; RM 11341; FCC 21-44; FR ID 27947]

Allocation of Spectrum for Non-Federal Space Launch Operations

AGENCY: Federal Communications Commission.

ACTION: Proposed rule.

SUMMARY: In this document, the Federal Communications Commission (Commission) takes steps towards establishing a spectrum allocation and licensing framework that will provide regulatory certainty and improved efficiency and that will promote innovation and investment in the United States commercial space launch industry. In the Further Notice of Proposed Rulemaking, the Commission seeks comment on the definition of space launch operations, the potential allocation of spectrum for the commercial space launch industry, including the 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands. In addition, the Commission seeks comment on establishing service rules, including licensing and technical rules and coordination procedures, for the use of spectrum for commercial space launch operations. Finally, the Commission seeks to refresh the record on potential ways to facilitate Federal use of commercial satellite services in what are currently non-Federal satellite bands and enable more robust federal use of the 399.9-400.05 MHz band.

DATES: Comments are due on or before [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]; reply comments are due on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: You may submit comments, identified by ET Docket No. 13-115, by any of the following methods:

- Federal Communications Commission's Web Site: <http://apps.fcc.gov/ecfs/>. Follow the instructions for submitting comments.
- People with Disabilities: Contact the FCC to request reasonable accommodations (accessible format documents, sign language interpreters, CART, etc.) by e-mail: FCC504@fcc.gov or phone: 202-418-0530 or TTY: 202-418-0432.

For detailed instructions for submitting comments and additional information on the rulemaking process, see the SUPPLEMENTARY INFORMATION section of this document.

FOR FURTHER INFORMATION CONTACT: Nicholas Oros, Office of Engineering and Technology, at (202) 418-0636 or Nicholas.Oros@fcc.gov; Peter Trachtenberg, Wireless Telecommunications Bureau, at Peter.Trachtenberg@fcc.gov or 202-418-7369; or Kimberly Baum, International Bureau, at Kimberly.Baum@fcc.gov or 202-418-2752 For information regarding the PRA information collection requirements contained in this PRA, contact Cathy Williams, Office of Managing Director, at (202) 418-2918 or Cathy.Williams@fcc.gov.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's *Report and Order* and *Further Notice of Proposed Rulemaking (FNPRM)*, ET Docket No. 13-115, FCC 21-44, adopted and released on April 22, 2020. This document is available by downloading the text from the Commission's web site at <https://www.fcc.gov/document/fcc-seeks-make-spectrum-available-commercial-space-launches-0>. When the FCC Headquarters reopens to the public, the full text of this document also will be available for public inspection and copying during regular business hours in the FCC Reference Center, 45 L Street, NE, Washington, DC 20554. Alternative formats are available for people with disabilities (Braille, large print, electronic files, audio format) by sending an email to FCC504@fcc.gov or calling the Commission's Consumer and Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (TTY).

Synopsis

1. In this *FNPRM*, the Commission continue its efforts to support commercial space launch operations and federal use of commercial space services. Specifically, the Commission proposes to add a non-Federal allocation in the 2025-2110 MHz band to support such operations, and the Commission seeks further comment on adding non-Federal allocations for commercial space launch operations in the 420-430 MHz, 2200-2290 MHz, and 5650-5925 MHz bands. The Commission further proposes to adopt a licensing framework and a set of technical rules to govern space launch operations services in the 2200-2290 MHz band, as well as the other three bands if they are ultimately allocated for commercial space launch purposes. In addition, the Commission seeks comment on whether to amend any of the rules applicable to space launch operations in the 2360-2395 MHz bands. The Commission seeks comment on

various licensing frameworks to authorize a variety of telemetry, tracking, and command operations between launch vehicles and ground stations during the initial launch and reentry phases of space launch operations. The Commission also seeks comment on whether there are additional measures that should be considered in order to facilitate radio-frequency licensing of certain other types of space launch operations that may be currently addressed through experimental licensing, including communications between launch vehicles and satellites and communications in connection with certain payload activities. Finally, the Commission seeks to refresh the record on the matter of expanding Federal use of certain non-Federal FSS and MSS bands, including removing the footnote restriction on federal earth stations accessing federal space stations operating in the 399.9-400.05 MHz band.

2. In a 2013 *Notice of Proposed Rulemaking and Notice of Inquiry (NPRM)*, the Commission proposed to provide a primary allocation of spectrum in three bands for non-Federal use during space launches: 420-430 MHz, 2200-2290 MHz, and 5650-5925 MHz. The *NPRM* also proposed to add either a Federal Fixed Satellite Service (FSS) or Mobile Satellite Service (MSS) allocation or a footnote to allow Federal access to several frequency bands for satellite services that currently only support commercial satellite systems. The *NPRM* also addressed a 2012 NTIA request to change a footnote in the U.S. Table to enable Federal space stations to operate in the 399.9-400.05 MHz MSS band.

3. *420-430 MHz Band.* The 420-430 MHz band is used during launches from Federal launch sites to transmit a flight termination signal to a launch vehicle, if necessary. This signal will cause the launch vehicle to self-destruct if it goes off course and poses a danger to a populated area. The *NPRM* sought comment on whether the Commission should make a co-primary non-Federal Aeronautical Mobile allocation for the 420-430 MHz band and whether it should add a footnote to the U.S. Table restricting use of the allocation to self-destruct signals (*i.e.*, flight termination signals) during launches. The Commission has not received any STA requests for this band during space launches. This band is heavily used by Federal users, including the Department of Defense (DoD), for radiolocation applications.

4. The Commercial Spaceflight Federation notes that there has not been a need for this band by commercial companies because launches have occurred at government facilities which transmit the flight termination signals. However, the Commercial Spaceflight Federation claims that, as launches

increasingly occur at private spaceports, operators will need licenses for this band. The New Mexico Spaceport Authority agrees that commercial operators will want to operate their own flight safety systems. SpaceX may need access to the band in the future. Orbital ATK endorses adding a co-primary non-Federal allocation for 421 MHz rather than adding the allocation for the entire band. Blue Origin takes no position on use of this band and indicates that it does not use this band during launches.

5. The Commission seeks further comment on whether to adopt a footnote to the U.S. Table which adds a primary non-Federal Aeronautical Mobile allocation to the 420-430 MHz band, requires coordination of assignments with NTIA, and restricts use of the band to pre-launch testing of launch vehicles and sending flight termination signals to launch vehicles during launches. Because launches to date have occurred at Federal ranges, access to this band by commercial launch providers has not been necessary. The Commission expects this may change as companies transition towards using commercial launch sites in the future. Thus, adding this Aeronautical Mobile allocation may be critical for protecting the public during space launches. Because the intended use of this band is for safety-of-life applications, the Commission proposes to add the Aeronautical Mobile allocation on a primary basis so that its use will be on an interference-protected basis. Further, the Commission proposes to add this Aeronautical Mobile allocation for the entire 420-430 MHz band, rather than limit it to just 421 MHz as suggested by Orbital ATK, because the Commission cannot predict what frequencies will be available at the future at launch sites. As NTIA permits range safety operations (*i.e.*, flight termination systems) across 420-450 MHz, should the Commission expand the Aeronautical Mobile allocation to 420-450 MHz? Regardless of the frequency range of the allocation, use of the band would need to be coordinated with NTIA. In this *FNPRM*, the Commission also proposes licensing and service rules for use of this band, should the Commission adopt this proposed allocation.

6. While the U.S. Table does not have a Mobile allocation in the 420-430 MHz band, the International Table has a Mobile, except aeronautical mobile allocation, for all regions. Therefore, aeronautical mobile use of the 420-430 MHz band is contrary to the International Table. Consequently, other countries may permit radio services in the band that are not compatible with aeronautical mobile use of this band. If the Commission adopts an Aeronautical Mobile allocation for this band, does it need to place restrictions on use of the allocation to prevent harmful interference occurring to radio services in

other countries? Such restrictions could include prohibition of operations near international borders, power limitations, or use of directional antennas to direct transmission away from international borders.

7. *2025-2110 MHz Band.* The *NPRM* addressed three frequency bands commonly used by commercial space launch entities at that time. However, since the *NPRM* was adopted in 2013, the commercial space launch industry has also begun to use the 2025-2110 MHz band to transmit control signals to launch vehicles. The Commission has granted access to this band during space launches using STAs issued under its Part 5 experimental licensing rules. The Commission expects that use of this band by the commercial space launch industry will continue to grow in the future and that establishing a permanent allocation for these services will provide more reliable access to this band than the STA process. The Commission therefore proposes to amend the Allocation Table by adding a co-primary non-Federal space operation (Earth-to-space) allocation to the 2025-2110 MHz band.

8. The 2025-2110 MHz band is currently allocated for both Federal and non-Federal fixed and mobile use. The largest non-Federal use of the band is for the Broadcast Auxiliary Service (BAS) operating under Part 74 of the Commission's rules. BAS stations make it possible for television and radio stations to transmit program material from the site of a breaking news story or a major event to the studio for inclusion in a broadcast program. BAS stations are also used to transmit programming material from a studio to the broadcasting transmitter or between television broadcast stations. BAS shares the 2025-2110 MHz band with the Cable Television Relay Service (CARS) and the Local Television Transmission Service (LTTS), which "have technically and operationally similar stations[.]" The Commission's rules encourage BAS, CARS, and LTTS users of this band to consult with local coordination committees in selecting their frequencies to avoid causing harmful interference with each other's operations.

9. Since 2000, the 2025-2110 MHz band has been allocated for Federal space operation, space research, and earth exploration satellite services. While these Federal allocations are co-primary, these uses in general are not allowed to constrain BAS, CARS, and LTTS deployment and must be coordinated with these non-Federal operations. Federal use of these allocations continues to increase as Federal users seek to increase resiliency and deploy large constellations of smaller satellites. To date, sharing of this band between Federal operations and BAS, CARS, and LTTS users has been successful.

10. Federal primary fixed and mobile service allocations were added to the 2025-2110 MHz

band in 2014. Footnote US92 restricts Federal use of the band to the military services and places specific requirements upon federal systems to facilitate sharing of the band with incumbent Federal and non-Federal services. The military services' transition plans include the relocation of certain terrestrial systems from the 1755-1780 MHz band into the 2025-2110 MHz band. The process of relocating Federal systems into the band is currently on-going.

11. Multiple commercial space launch operators either have used or have indicated that they plan to use the 2025-2110 MHz band to support their launch operations. SpaceX has used this band to send command signals to the first stage of its Falcon 9 launch vehicle as it lands either on a recovery drone ship or on land. Blue Origin has used this band to transmit command signals to its suborbital New Shepard launch vehicle and plans to use it in the future for orbital launches of its New Glenn launch vehicle. Rocket Lab has used this band to conduct ground testing for its Electron Launch Vehicle and plans to use it in the future to command the third stage of its launch vehicles. These operations have been conducted using STAs issued by the Commission under its Part 5 experimental rules. The Commission expects that use of this band by the commercial space launch industry will continue to grow in the future. The Commission seeks comment on the projected future use of this band for space launch activities.

12. To support the commercial space launch industry, the Commission proposes to amend the Allocation Table by adding a co-primary non-Federal Space Operation (Earth-to-space) (space-to-space) allocation to the 2025-2110 MHz band. Given the heavy use of this band by BAS, CARS, and LTTS, and the increasing Federal use of the band, including for Federal space systems, these service rules will need to provide for coordination with these operations. As the Commission expects the number of launches to continue to increase in the future, the Commission believes that adopting this approach will be more feasible than relying on the current STA process. The Commission seeks comment on this allocation proposal.

13. The Commission proposes to allow use of the entire 2025-2110 MHz band without any restriction on where licensed launches may occur. The Commission notes that for the Space Operation allocation for the 2200-2290 MHz band, the Commission considered whether the use of that spectrum should be restricted to launches at Federal ranges. In addition, the Space Operation allocation the Commission is adopting for the 2200-2290 MHz band for space launches restricts non-Federal space

operations to specific portions of the band. Both of these restrictions were requested by NTIA to facilitate coordination with the existing Federal users of this bands. The Commission seeks comment on whether limiting launches to certain frequencies or locations is needed to facilitate coordination between non-Federal and Federal users. Should use of this band for space launches be limited to only portions of the band? Considering the restrictions placed on Federal uses of the band, should these same restrictions be placed on new non-Federal uses of the band? Are other restrictions also required to protect the incumbent and incoming Federal uses of the band? Is there any reason to restrict use of the band to launches conducted at specific locations such as at Federal ranges or FAA licensed launch sites given that the Commission are not placing any such restrictions on use of the Space Operation allocation the Commission are adopting for the 2200-2290 MHz band? Considering the Federal and non-Federal uses of the band, would it serve the public interest to adopt any of these restrictions? The Commission notes that many recent launches using this band have been conducted from either Federal ranges or FAA licensed launch sites. For example, SpaceX has launched from Cape Canaveral, Florida and Rocket Lab has conducted launch testing at Wallops Island, Virginia. However, Blue Origin has launched from Van Horn, Texas, which is neither an FAA licensed launch site or at a Federal range. Should use of the Space Operation allocation be limited to space launches or are there other kinds of space operation uses that may be appropriate for this band? Are there any other restrictions that are needed to facilitate sharing of the band between the non-Federal space operation service and the other users of the band, in particular BAS, CARS, and LTTS?

14. *2200-2290 MHz Band.* In addition to a Space Operation allocation, both the International Table and the Federal Table include a Mobile Service allocation allowing aeronautical mobile use. Would it serve the public interest to modify the non-Federal allocations for the 2200-2290 MHz band to include a Mobile Service allocation in this band to facilitate licensing of commercial space launch operations in the commercial space launch operations context? The Commission notes that three frequencies in the 2360-2395 MHz band are available for both Federal and non-Federal use for telemetry and telecommand of launch and reentry vehicles under a Mobile allocation and its Part 87 rules. This use is identical to the launch vehicle telemetry for which space launch providers have obtained STAs for the 2200-2290 MHz band. To harmonize the allocation status and the applicable service rules of the 2200-

2290 MHz and 2360-2395 MHz bands, it may be appropriate to adopt a Mobile allocation for the 2200-2290 MHz band in addition to the Space Operation allocation the Commission has adopted. Therefore, the Commission seeks comment on whether the Commission should add a non-Federal secondary Mobile allocation to the 2200-2290 MHz band. What are the benefits and costs of subjecting commercial space launch operations to both terrestrial mobile service and space operations regulatory frameworks? Does the Commission need to define the boundary between, when and how mobile service rules or space operations rules apply to space launch operations, if both allocations together cover the operations? If so, would it serve the public interest to make this boundary depend on the stage of the launch vehicle—earlier or later stages? How should the Commission define such stage boundaries? If the Commission were to divide space launch operations into stages, how should the Commission define space launch vehicles and should such a definition include any spacecrafts carrying payloads to their orbital locations? What are the domestic and international legal and policy ramifications of adopting such a clear dual allocation and service rules approach where the communications emanating from the same equipment would be considered under both terrestrial and space services allocations, and be regulated under one or the other, depending on the launch vehicle's position in its trajectory and distance from the earth? Alternatively, should the Commission regulate a space launch vehicle's operations throughout its trajectory under a single rule part? Commenters should discuss how the Commission can provide the most flexibility with the least regulatory burden while serving the public interest.

15. If the Commission adopts a non-Federal secondary Mobile allocation, the Commission proposes to implement this allocation by modifying the footnote to the U.S. Table that the Commission has adopted to implement the Space Operation allocation in the 2200-2290 MHz band. Similar to the non-Federal space operations allocation, this mobile allocation footnote would restrict use of the band to pre-launch testing and space launch operations and require coordination of use of the band with NTIA prior to each launch. Are all of these restrictions appropriate for the Mobile allocation in this band? The Federal Mobile allocation for the 2200-2290 MHz band is currently restricted to line-of-sight use only, including aeronautical telemetry; excludes flight testing of manned aircraft; and prohibits the introduction of high-density mobile systems. Would it be appropriate to adopt any of these limitations on use of the non-Federal Mobile allocation? Are any other limitations on use of the non-Federal Mobile allocation

necessary?

16. The Space Operation Service is defined in the Commission's rules as being "concerned exclusively with the operation of spacecraft, in particular space tracking, space telemetry, and space telecommand." As the non-Federal Space Operation allocation the Commission has adopted in the Report and Order is limited to use for pre-launch testing and during space launch operations the use of this allocation is limited compared to what would normally be permitted under a Space Operation allocation. The Commission seeks comment on whether a greater range of non-Federal space operations should be permitted under the Space Operation allocation in this band—*i.e.*, should the restrictions the Commission has placed on use of this allocation be modified, reduced, or eliminated? Expanding the scope of this allocation could be especially useful for permitting communication between spacecraft during orbital and suborbital missions. For example, SpaceX has used the 2200-2290 MHz band for communication between its Dragon spacecraft and the International Space Station. As the commercial space industry continues to develop, the need for communication with and tracking of spacecraft is likely to increase. Is there a need for a non-Federal space operation (space-to-space) allocation in this frequency band, similar to the Federal allocation? In considering modifying any restrictions on non-Federal use of this band, the Commission must keep in mind the need to protect Federal operations in this band. How could permitting greater non-Federal space operations activities in the band be done while preventing harmful interference to Federal operations?

17. The non-Federal Space Operation allocation the Commission has adopted for the 2200-2290 MHz band is limited by US96 to four subbands: 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz. Recent space launches that have accessed this band for telemetry using STAs have used different portions of the band than these four subbands. The fact that the channels used for these launches were successfully coordinated with NTIA indicates that it may be possible to provide additional flexibility to space launch operators rather than limiting access to only these four subbands. To provide this flexibility, the Commission proposes to remove the restriction in US96 limiting use of the band for non-Federal space operations to the four subbands. Instead, under this proposal use of the Space Operation allocation during pre-launch testing and space launch operations could potentially occur in any portion of the 2200-2290 MHz band. Because of the heavy use that Federal agencies make of this band,

use of this band for launches will need to be coordinated with NTIA. As Federal use of this band is likely to evolve over time, this coordination with NTIA will be necessary on a launch-by-launch basis.

18. While the Commission is proposing to remove the limitation on use of the Space Operation allocation to four subbands, it may still be appropriate to place some limitations on the spectrum that may be used during launches because the band will be shared with Federal users. The subbands currently in US96 are each 5 megahertz wide with a total of 20 megahertz of spectrum potentially available for use for each launch. Should non-Federal use of this allocation be limited to channels with a necessary bandwidth of 5 megahertz as is currently required by US96? Should there be a limit on the total amount of spectrum available for use during a launch? If the Commission places limitations on the bandwidth in each channel or total bandwidth per launch, should there also be a means for these limits to be waived if there is sufficient justification? If the Commission leaves in place the restriction on non-Federal use of the 2200-2290 MHz band to a limited set of subbands, should the subbands be adjusted to reflect the fact that recent launches have used channels outside of these subbands?

19. While the *NPRM* proposed that the Commission adopt a primary Space Operation allocation for the 2200-2290 MHz band, the Commission has instead adopted a secondary allocation. Several commenters advocate adoption of a primary allocation claiming that it will lead to streamlined licensing, eliminate repeated licensing work, require less coordination, and provide greater certainty with respect to approvals. Although the secondary allocation the Commission adopts is clearly preferable to the current STA process, adopting a primary allocation may nevertheless be the most appropriate long-term band management policy. Adopting a primary allocation would place commercial launch operators on an equal footing with other users of the band and provide greater certainty to incentivize investment as the commercial space industry continues to expand with more frequent launches, privately developed launch facilities, and manned space flights. Therefore, the Commission seeks comment on whether it should adopt a primary Space Operation allocation for the 2200-2290 MHz band. The Commission notes that even if it adopts a primary non-Federal allocation for this band, individual launches would still have to be coordinated with NTIA because of the heavy existing Federal use of the band.

20. *5650-5925 MHz Band.* The 5650-5925 MHz band is used for radar tracking of launch

vehicles during launches. This often involves placing a radar transponder on the launch vehicle, which responds to a ground-based radar signal that transmits tracking information back to the tracking station. Because launches in the past have occurred at Federal ranges, the radar tracking stations used during the launches have been Federal facilities. However, commercial launch providers have obtained experimental STAs for transponders on the launch vehicles that operate in the band.

21. The *NPRM* made two alternate proposals for providing commercial entities access to this spectrum for radar tracking during launches. Under the first proposal, the *NPRM* proposed to add a footnote to the U.S. Table providing a primary non-Federal radiolocation service allocation. The footnote would restrict use of the allocation to launches and pre-launch testing and would require coordination with NTIA. In a second proposal, the *NPRM* proposed to add a primary non-Federal radiolocation service allocation to the 5650-5925 MHz band with a footnote containing the same restrictions. The *NPRM* asked a number of questions concerning use of the band, such as the operational requirements for radar tracking during space launches, whether other radiolocation bands could be used, and if there are compatibility issues with Intelligent Transportation Systems that are primary in a portion of the band.

22. In response to the 2013 *NPRM*, the Commercial Spaceflight Federation recommended adding a non-Federal allocation to the 5650-5925 MHz band, noting that the band is used by Federal radar facilities to track launches from government-owned facilities. The New Mexico Spaceport Authority applauded the Commission in recognizing the potential to mix Federal and commercial equipment within one system or service and requests that the Commission design future regulations to promote interoperability between Federal and commercial systems. The Aerospace Industries Association argued that no allocation is needed for the band, given that the band is used for radar tracking from the Federal launch range, which is managed by the range. Orbital ATK endorsed adding a non-Federal allocation to the band at 5765 MHz. No commenters who have discussed the needs of the commercial space industry with Commission staff in the past year have indicated an interest in using this band during space launches. In recent years, only one licensee has obtained licenses for use of the 5650-5925 MHz band.

23. The Commission seeks further comment on whether to adopt a non-Federal Radiolocation allocation for the 5650-5925 MHz band by adding a footnote to the U.S. Table. Should such an allocation be limited to use for pre-launch testing and tracking of launch vehicles? Radar

transponders transmitting from commercial launch vehicles require licenses from the Commission, even if the vehicle is launched from a Federal or commercial launch site and tracked by a Federal ground-based radar tracking facility. As there currently is no non-Federal Radiolocation allocation for this band, the Commission issues experimental STAs to authorize operations in the 5650-5925 MHz band to support commercial launches. This case-by-case procedure may become more burdensome as the commercial launch industry grows. However, given the apparent low interest in this band for radar tracking during launches, there may be no need to adopt this allocation. Hence, the Commission seeks comment on the number of launches likely to need access to this band in the future. Given that recent STAs issued for use of this band have used only the 5758-5772 MHz portion of the band, should the allocation be limited only to a portion of the band? Should the allocation be primary or secondary? Should use of the band be limited to specific locations such as Federal ranges or FAA-licensed launch sites?

24. In addition to having an allocation for Federal radiolocation, the 5650-5925 MHz band is shared with other services. The 5850-5925 MHz band has a primary non-Federal Mobile allocation with use of this allocation in the 5895-5925 MHz band limited to the Intelligent Transportation System radio service. Because launch facilities are generally not located near public roads and the signal emanates from high in the sky, ensuring a weak signal at ground level, the Commission expects negligible, if any, impact on Intelligent Transportation Systems in the upper portion of the band. Is this expectation reasonable? If use of this band for space launches would impact Intelligent Transportation Systems in the upper portion of the band, are there specific accommodations the Commission could take to minimize that impact? The 5650-5895 MHz band is currently used by Unlicensed National Information Infrastructure (U-NII) devices operating under the Commission's Part 15 rules. U-NII devices operating in the 5650-5725 MHz portion of the band employ dynamic frequency selection (DFS) to detect the presence of radar signals to avoid causing interference. Will DFS successfully enable coexistence between U-NII devices and space launch radars in this portion of the band? In the 5725-5850 MHz band, U-NII devices operate without the use of DFS. Are there steps the Commission could take to minimize interference between space launch radar operations and U-NII and ITS operations in the upper portion of the band? If interference between these operations is likely, should the Commission limit this new radar allocation to the frequencies below 5725 MHz? The 5850-5925 MHz band is also allocated to the fixed-satellite

service in the uplink direction with use limited to international, inter-continental systems. Given the limited number of earth stations and limited number of launch sites, the Commission expect that sharing would be feasible though coordination. The Commission seeks comment on this view.

25. *Licensing and Technical Rules for Space Launch Operations.* In this section, the Commission proposes to adopt rules for new non-Federal space launch operations. As an initial matter, the Commission seeks comment on how to define non-Federal “space launch operations.” The STAs that the Commission has granted in the 2200-2290 MHz band, for example, have included telemetry from the launch vehicle and the payload, during the initial space launch, the orbital phase (including docking with the ISS), and return and reentry of the space launch vehicle. If the Commission were to cover communications needs during these operations, do these operations include all activities that may be needed for a successful commercial space launch operation? Would it serve the public interest to include all of these operations in the definition of “space launch operations”? Is there a need to limit or further expand the definition to include other space operations? The Commission also seeks comment on whether and how to define “space launch vehicle” and whether there should be any distinction between a “launch vehicle” or a “reentry vehicle” for space launch operations purposes. The Commission seeks to establish rules that flexibly, efficiently, and effectively support the evolving spectrum requirements of commercial space launch operations while continuing to adequately protect vital Federal operations in the bands. In that regard, the Commission seeks comment on the appropriate licensing and technical rules to meet these goals. First, the Commission seeks comment on the appropriate licensing framework for the non-Federal space launch operations in the 2200-2290 MHz band, the proposed non-Federal space launch operations in the 420-430 MHz and 2025-2110 MHz bands, and the potential non-Federal launch tracking operations in the 5650-5925 MHz band. The Commission also seeks comment on which Commission rule parts should apply to different elements of space launch operations, and on how to integrate these various provisions to facilitate operations of space launch services, including potentially by creating a new stand-alone rule part. The Commission proposes and seeks comment on specific licensing rules, such as rules governing scope of service, eligibility, license period, application processing rules, and coordination requirements, as well as technical rules that will foster interoperability of equipment used for non-Federal and Federal launches and rules regarding equipment authorization. Finally, the Commission

seeks comment on whether the Commission should update any rules regarding space launch vehicle use of aeronautical telemetry in the 2360-2395 MHz band.

26. *Applicability of Certain Sections of Part 87 (Aeronautical Mobile).* Existing licensing and operating rules under Part 87 currently support commercial space launch operations in the 2360-2395 MHz band and offer an established regulatory approach. The telemetry and telecommand uses identified for the non-Federal space launch operations in the 2200-2290 MHz band and the proposed non-Federal operations in the 420-430 MHz and 2025-2110 MHz bands are similar to space launch telemetry uses permitted in the non-Federal 2360-2395 MHz band, which are supported under Part 87, Subpart J flight testing rules. The Commission seeks comment regarding which rules under Part 87 would be the most appropriate model for non-Federal operations in the 2200-2290 MHz, 420-430 MHz, and 2025-2110 MHz bands, as well as associated telemetry and telecommand functions, and on the benefits and costs of applying such rules. In Appendix D, the Commission sets forth proposed Part 87 rules that could be applied to these operations in these bands, if the Part 87 model is adopted.

27. The Commission notes that the initial launch and reentry phases of a space launch operation share some, but not all, of the characteristics of conventional aviation services, specifically flight test and aeronautical mobile telemetry uses, which are regulated under Part 87. Space launch operations may need additional flexibility for communications with ground stations in the United States, abroad, in space, and in some instances with other space stations, including satellites. The Commission also notes that certain Part 87 licensing and operational rules, while relevant to conventional aviation services generally, may not be appropriate for space launch operations. The Commission seeks comment on whether there are Part 87 general licensing and technical rules that may not be applicable for purposes of developing a regulatory framework for commercial space launch operations.

28. *Applicability of Part 90 (Private Land Mobile).* With respect to launch vehicle radar tracking functions, the Commission seeks comment on administering the proposed 5650-5925 MHz band radiolocation allocation as part of the Radiolocation Service, which is currently regulated under Part 90. In what phases of space launch operations is this radar tracking function needed? Are there any space launch operations phases, including orbital phases, that may require the Commission to formulate additional radar tracking rules and, if so, what are those and why would they be needed? The

radiolocation uses for the 5650-5925 MHz band differ from the aeronautical telemetry uses governed under the Part 87 rules. Because radiolocation operations are generally regulated under Part 90, the Commission proposes to apply the existing licensing framework to the 5650-5925 MHz radiolocation use. This would apply to ground stations as well as to associated transponders affixed to the space launch vehicle for tracking purposes. The Commission seeks comment on the benefits and costs of this proposal and on other possible licensing frameworks. Specifically, is Part 90 the appropriate licensing mechanism for ground stations and transponders affixed to the launch vehicle or should ground stations and associated transponders be licensed under Part 87? In Appendix D, the Commission set forth proposed Part 90 rules that could be applied to these operations in this band, if the Part 90 model is adopted.

29. *Applicability of Part 25 (Satellite).* The Part 25 rules provide for authorization of both space stations and earth stations. Under Part 25, a “space station” is defined as a station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere; “space radiocommunications” is defined as any radiocommunication involving the use of one or more space stations. In addition, Part 25 includes a definition for “spacecraft” as a man-made vehicle which is intended to go beyond the major portion of the Earth's atmosphere. Given that space launch vehicles are intended to go beyond the major portion of the Earth's atmosphere, safely deliver their payloads (typically satellites), and then reenter the atmosphere, the Commission seeks comment on the benefits and costs of applying the definition of space stations under Part 25 of its rules, to radio communications stations on space launch vehicles. Additionally, some communications between launch vehicles and ground stations/earth stations may be conducted consistent with the Commission's rules applicable to earth stations and a space operations allocation in the U.S. Table of Frequency Allocations. The Commission notes that the Part 25 rules, including space station and earth station licensing processes, are designed to license spectrum use by commercial space services. The Commission seeks comment on which Part 25 rules could be applied, or used as a model for, the licensing of a space launch vehicle's communications through its full trajectory, and on the benefits and costs of this approach.

30. *Integrating the Authorization of Space Launch Operations across Rule Parts.* The Commission recognizes that while a space launch operation may involve distinct telemetry, tracking, and command operations uses, it may be more practical to address all functions under a stand-alone rule part.

Another option would be to create one or more subparts specifically to support commercial space launch telemetry, tracking, telecommand, and other communications needs of space launch operations. These subparts could establish the conditions under which frequencies would be licensed for use during a space launch. The Commission seeks comment on these approaches or on any alternate approaches. How can the Commission facilitate reliable access to spectrum while meeting the changing communications needs of space launch operations during any point of a space launch vehicle's trajectory? The Commission seeks comment on the best way to authorize the use of the relevant spectrum bands to cover space launch operations, starting at the launch site through the launch vehicle's trajectory and until its final destination, including reentry, in a flexible, efficient, and effective manner. Commenters should discuss the costs and benefits of any licensing approach that they propose.

31. Licensing Rules for Space Launch Operations. In the *Report and Order*, the Commission adopts a secondary allocation for the 2200-2290 MHz band to support the current level of commercial launches and enable the continued growth of the commercial space launch industry. Consistent with the *Report and Order*, the Commission proposes certain service rules for the 2200-2290 MHz band and for the additional bands discussed herein.

32. As noted, the non-Federal space operations allocation the Commission has adopted for the 2200-2290 MHz band includes a restriction and limits pre-launch testing and space launch operations to the 2208.5-2213.5 MHz, 2212.5-2217.5 MHz, 2270-2275 MHz, and 2285-2290 MHz subbands. Consistent with the current allocation, the Commission seeks comment on restricting the use of the 2200-2290 MHz band for pre-launch testing and space launch operations to these four subbands in its service rules. Contingent on the adoption of this proposal, the Commission proposes to permit licensees to use additional frequencies outside the four subbands upon adequate justification for why such additional frequencies are necessary and in the public interest, on a case-by-case basis. Any requirement for frequencies for use during launches will have to be balanced with the use of the band by Federal systems and coordinated with NTIA. As noted in the *Report and Order*, any use will be limited to the telemetry and tracking operations of launch vehicles during pre-launch testing and during space launch operations. In the *FNPRM* above, however, the Commission also seeks comment on whether to remove the allocation restriction limiting use of the 2200-2290 MHz band for non-Federal space operations to the four

subbands, such that use of the Space Operation allocation during pre-launch testing and space launch operations could potentially occur in any portion of the 2200-2290 MHz band. Thus, the Commission also seeks comment on whether, to provide greater flexibility in spectrum use, the Commission should remove any presumptive limitation to the four subbands in the service rules as well given that the use of any spectrum in the 2200-2290 MHz band would be separately coordinated for each launch.

33. The Commission also proposes to add a provision restricting use of the proposed 420-430 MHz allocation to the transmission of flight termination signals during pre-launch testing and launches. This transmission would provide for a flight termination signal if a space launch vehicle goes astray. Because a launch vehicle which has gone off-course can endanger lives, the flight termination signal link must be extremely reliable. Therefore, it may not be possible to permit additional uses—particularly those that are not safety-of-life services—in the band.

34. Further, the Commission proposes to restrict the commercial launch use of the 2025-2110 MHz band to telecommand uplink transmissions from the ground controller stations to the space launch vehicle in the event that the Commission adds a non-Federal Space Operation allocation to this band. This allocation would enable space launch providers to transmit to their space launch vehicles during the launch and recovery phase of operations. The largest use of the 2025-2110 MHz band is for the BAS. This band is heavily used by BAS, CARS, and LTTS operations, as well as by Federal entities for space operations, space research, and the earth exploration satellite service. Considering these existing operations, as well as operations by non-Federal launches on a special temporary authority basis to date, is it feasible to accommodate uses in addition to the space launch telecommand uses described above?

35. The Commission further proposes to add a restriction to limit use of the 5650-5925 MHz band to launch vehicle tracking. Although frequencies in the 5650-5925 MHz band are available to support certain non-Federal uses, the predominant use in the band is radiolocation, with Federal entities using the band for a wide variety of radar applications, including launch vehicle tracking. In order to promote interoperability with existing Federal radar tracking functions and to limit impact to other uses, the Commission proposes to restrict commercial space launch vehicle uses of this band to radar tracking.

36. The Commission seeks comment on these proposals. In particular, the Commission seeks comment on whether these proposals provide sufficient flexibility for existing and future needs of non-

Federal launch activities or whether additional uses should be accommodated if technically feasible.

Additional uses in the bands beyond those specified above may not currently be possible due to technical characteristics and existing uses of the bands. However, the Commission seeks comment on whether to provide flexibility to enable other uses if it determines such uses are technically feasible and will not restrict or cause harmful interference to existing uses and incumbent operations. The Commission seeks comment on the costs and benefits of limiting the scope of uses in these bands. Commenters also should discuss what other measures the Commission should consider to promote a competitive marketplace for space launch operations and services.

37. *Eligibility.* In the *Report and Order*, the Commission explains that opening this spectrum to the commercial space launch industry would encourage entrepreneurial efforts by providing commercial space entities certainty in their access to the spectrum that they need to promote the advance planning and investment necessary for future space launch activities. The Commission therefore proposes to limit eligibility to hold authorizations for the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands to non-Federal entities that conduct space launch operations. The Commission seeks comment on the extent to which the supplemental eligibility criteria for flight test stations, set forth in § 87.301, would be an appropriate model for space launch license eligibility. To be eligible for a new commercial space launch license, the Commission proposes that the applicant must qualify as one of the following: (1) an operator or manufacturer of a commercial space launch or reentry vehicle or space launch or reentry vehicle components; (2) a parent corporation or its subsidiary if either corporation is an operator or manufacturer of a space launch or reentry vehicle or space launch or reentry vehicle components; or (3) an educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of a launch or reentry vehicle or launch or reentry vehicle components. The Commission also seeks comment on whether to allow other entities that provide space-based services, including satellite service providers, to be eligible for commercial space launch licenses. The Commission seeks comment on these eligibility restrictions, including whether to expand or further restrict the scope of eligible entities.

38. Currently, each application for a flight test license under Part 87, Subpart J is required to include a certification to establish the applicant's eligibility for a license. Similarly, the Commission

proposes to use this as a model to require an applicant for any commercial space launch frequencies to certify the eligibility criteria proposed above. The Commission tentatively concludes that requiring this certification would be in the public interest and impose minimal burden on eligible entities. The Commission seeks comment on this proposal as well as on whether to impose any additional certification requirements. In some cases, the Commission has also required subsequent certifications by a licensee that stations comply with applicable technical requirements, such as in § 25.133 of the Commission's rules. The Commission seeks comment on whether to require such a certification, through an appropriate check-box, by either license applicants or licensees.

39. *Shared Frequency Use and Cooperative Use of Facilities.* The Commission proposes to provide non-Federal space launch operators access to the 2200-2290 MHz band as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz bands on a shared, non-exclusive basis. The Commission traditionally has issued Part 87 licenses on a shared basis and not for the exclusive use of any licensee. Certain Part 90 radiolocation uses are also authorized on a similar shared basis. Similarly, the Commission's Part 25 satellite licensing rules also include provisions relating to shared and cooperative use of spectrum. Given that there is the potential for many different launch vehicle operators to use a given launch area, authorizing commercial space operations on a shared basis appears to be a reasonable approach for providing spectrum access for multiple space launch entities. It should be noted that, in this context, shared use status, while non-exclusive, does not mean that a licensee will be required to accept interference. The licensee will be entitled to interference protection for its launch operations. The Commission seeks comment on this proposal and request comments on other viable options.

40. Further, in the context of flight test operations, Part 87 generally limits authorizations of flight test land stations to only one per airport, but it requires that these stations be made available without discrimination to anyone eligible for a flight test station license. This rule has enabled the shared use of facilities, which has reduced costs to licensees and promoted efficient use and competition in the aviation industry.

41. The Commission seeks comment on whether a similar non-discrimination policy for all space launch operations in the bands at issue is also necessary. The Commission is aware that there are launch sites that currently have ground transmitters for shared use, and it seeks comment on the practices

involving ground stations at Federal ranges and FAA-licensed sites. Should the Commission adopt rules providing for non-discriminatory access of these facilities by non-Federal space launch entities? The Commission seeks comment on whether non-discriminatory shared use of these facilities is necessary to support the existing and future needs of commercial space launch entities. The Commission seeks further comment on the costs and benefits of a cooperative use of facilities approach, as well as other facilities that may require non-discriminatory access and ways to streamline these practices.

42. In licensing space launch operations, the Commission's goals are two-fold: (1) to encourage innovations and investments in the U.S. space commerce; and (2) to ensure a regulatory environment conducive to the establishment of a competitive U.S. commercial space launch sector while protecting Federal and other users in the bands. In this *FNPRM*, the Commission seeks comment on various licensing models with these goals in mind and aim to bring regulatory certainty in the marketplace while minimizing administrative burden and duplicative regulations.

43. *Site-Based Licensing.* A number of Part 87 services, including flight test station licenses, and Part 90 radiolocation services are authorized on a site-by-site basis. A site-based licensing model is helpful in a shared use situation as fixed, well-defined areas of operation simplify coordination during the application process for services requiring frequency coordination, and facilitate intensive spectrum sharing. Moreover, this approach enables the Commission and interested stakeholders to identify quickly licensees in the band and their specific areas of operation in the event interference issues arise, which allows parties to resolve such issues in the shortest timeframe practicable. The Commission seeks comment on these conclusions and whether to issue space launch licenses on a site-by-site basis. Would site-based licensing meet the needs of space launch operations? Does site-based licensing enable the safe and efficient operation of shared frequencies while providing the certainty and flexibility needed to support the existing and future needs of commercial space launch entities? Are space launch activities centered usually around certain sites? If the Commission were to adopt site-based licensing, how should the it define a site?

44. *Other Licensing Options.* The Commission also seeks comment on whether there are any other licensing models that may be suitable in the space launch operations context. For example, would it be appropriate to license specific space launch vehicles and list applicable ground stations (including

those at the launch sites licensed by FAA) as authorized communications points with those vehicles?

Another option would be to adopt a new approach combining various aspects of space-based services and aeronautical service licensing rules. If the Commission does so, what are the rules that would be most appropriate for licensing space launch services? Stations on space launch vehicles could be licensed similar to space stations and the communicating ground/earth stations could be licensed on a single or multiple site basis. A ground/earth station's operations also could be conditioned, for example, on filing of a certification before a planned space launch to certify that any required frequency coordination has been satisfactorily completed and the relevant ground/earth stations are in compliance with all applicable legal and technical rules that the Commission might adopt for space launch operations. Or licensing of space launch operations could be similar to licensing models applicable to certain wireless services such as the 3650-3700 MHz band, and the 71-76 GHz, 81-86 GHz, 92.0-94.0 GHz, and 94.1-95.0 GHz bands. Pursuant to these approaches, space launch operators could have access to various spectrum bands on a non-exclusive, yet protected, basis, but would be subject to measures designed to promote shared use of spectrum, such as a registration and frequency coordination requirement prior to each launch. With respect to the terrestrial nationwide, but non-exclusive, licensing approach, which typically has been used for shorter-distance terrestrial wireless services, could such a licensing approach be effective as applied to all phases of operations, including orbital phases? Could such a licensing process streamline the information that would be needed for initial licensing and then registration and coordination prior to a planned launch? The Commission seeks comment on the feasibility, costs, benefits, and potential challenges (if any) associated with each of these proposals.

45. Comments should discuss any needed changes that should be made to reduce potential administrative burdens and streamline the site-based licensing process as well as any other alternatives. The Commission also seeks comment on service area definitions as well as alternatives and the costs and benefits of proposed alternatives.

46. *Authorized Bandwidth.* The Commission proposes to grant licenses for non-Federal operations in the 2200-2290 MHz band using a 5 megahertz bandwidth, similar to NTIA's limit for transmissions by Federal space-to-Earth operations in the band. The Commission further seeks comment on permitting licensees to use larger bandwidths upon adequate justification for why such bandwidth are

necessary and in the public interest, on a case-by-case basis. Any requirement for additional bandwidth for use during launches will have to be balanced with the use of the band by Federal systems and coordinated with NTIA. The Commission's review of experimental authorizations requested for the 2200-2290 MHz band indicates that the majority of applications involved requests for bandwidths of less than 5 megahertz. The Commission tentatively concludes that licensing the 2200-2290 MHz band in 5 megahertz channel blocks will likely accommodate most non-Federal launch vehicle operations in the band and provide licensees with greater flexibility than authorizations with a smaller bandwidth. This approach is consistent with NTIA's stated preference. The Commission seeks comment on this approach as well as other approaches. The Commission notes that 2360-2395 MHz band space launch telemetry and telecommand operations may be authorized in bandwidths of 1, 3, and 5 megahertz. Should the Commission similarly authorize the 2200-2290 MHz band in a range of bandwidths?

47. As discussed, the Commission is proposing to allocate the entire 420-430 MHz and 2025-2110 MHz bands for flight termination and telecommand uses, respectively, and is seeking comment regarding the portions of the 5650-5925 MHz band that should be allocated for launch vehicle tracking purposes. The Commission seeks comment on the appropriate bandwidth or spectrum blocks for the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz allocations. The Commission notes that the bandwidths associated with experimental authorizations granted for frequencies in the 2025-2110 MHz and 5650-5925 MHz bands have varied in size. The Commission seeks comment on the typical and/or necessary bandwidths applicable to the space launch uses specified in this proceeding. Consistent with an NTIA recommendation, the Commission further seeks comment regarding the 420-430 MHz band, specifically on "the most appropriate frequencies . . . for each designated launch facility based on which frequencies can be supported for sending command destruct/flight termination signals."

48. *License Term and Renewal.* The Commission historically has established ten-year terms for wireless radio service licenses, including Part 87 aviation and Part 90 radiolocation licensees. In the satellite licensing context, most satellites are authorized for a 15-year license term. The Commission tentatively concludes that ten-year terms will provide certainty and flexibility for space launch providers and therefore proposes to issue commercial space launch licenses for ten-year terms. The Commission recognizes, however, that the spectrum and use must be carefully managed and coordinated due to the

heavy use of these bands, and the Commission notes that it has granted shorter license terms for Part 87 flight test stations pursuant to the frequency coordination process as a means to manage and ensure periodic reevaluation of possible interference issues. Several commenters have suggested a shorter five-year period as an appropriate license term. The Commission seeks comment on alternative license terms.

49. The Wireless Radio Services (WRS) proceeding established the process for renewing a site-based license. Specifically, it provided that a site-based WRS licensee will meet our renewal standard if it can certify that it is continuing to operate consistent with its most recently filed construction notification (or most recent authorization, when no construction notification is required), and make the certifications regarding permanent discontinuance and substantial compliance with Commission rules and policies that are applicable to all renewal applicants seeking to avail themselves of one of the renewal safe harbors. Services subject to this site-based renewal standard include the Part 90 Radiolocation Service. The Commission proposes to extend this renewal standard to licensees in the 5650-5925 MHz band to the extent the Commission applies the Part 90 Radiolocation Service rules to this band. The Commission request comment on this proposal.

50. The *WRS Order* does not apply to Wireless Radio Services that are licensed by rule or on a “personal” basis or that have no construction/performance obligation. This includes most Part 87 services. The Commission seeks comment on whether to require commercial space launch licensees make a “renewal showing,” for instance, certifying that it is operating consistent with its initial application for authorization or that it has complied with the required coordination. The Commission seeks comment on whether this renewal showing is warranted for the bands at issue given the heavy use by Federal agencies. The Commission believes that requiring a renewal showing in these bands would facilitate efficient spectrum use by ensuring that licensees use the spectrum productively, collaboratively, and in compliance with Commission rules during their initial license terms. The Commission seeks comment on the costs and benefits of imposing a renewal requirement for commercial space launch operations licensees.

51. *Application Process.* The Commission seeks comment on the application process to be used to assign commercial space launch licenses. As an initial matter, the Commission seeks comment on whether assignment of space launch operations licenses is subject to Section 309(j) of the

Communications Act. The Commission notes that, while Section 309(j) of the Communications Act requires that it assign spectrum licenses through the use of competitive bidding for mutually exclusive license applications, the shared, non-exclusive licensing the Commission is proposing for the spectrum bands at issue would not result in mutually exclusive applications and thus would not be subject to such competitive bidding requirements. However, where Section 309(j) applies and to the extent that the Commission determines that it is in the public interest to adopt a licensing scheme that would result in mutually exclusive license applications, it proposes to use the general competitive bidding rules set forth in Part 1, Subpart Q, of the Commission's rules. The Commission seeks comment on these conclusions and proposals.

52. With respect to application framework, the Commission is aiming to establish an application framework that would increase the regulatory certainty while reducing the administrative burden. One approach would be to apply the existing licensing framework for Part 87 and Part 90 licensees to commercial space launch operations applications. Currently, applicants for Part 87 flight test stations and Part 90 radiolocation licenses are required to submit FCC Form 601 and associated schedules through the Universal Licensing System (ULS). The Commission seeks comment on requiring applicants seeking authorization for 2200-2290 MHz as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz frequencies to file an FCC Form 601 and applicable schedules through ULS under the appropriate rule part designation. The Commission seeks comment on the benefits and costs of this approach. Another approach would be to use aspects of Form 312 and Schedule S, with narrative legal and technical information similar to licenses under Part 25 and filing in the International Bureau Filing System (IBFS). The Commission seeks comment on these and any alternative approaches.

53. Depending on the licensing scheme, for example, if the Commission adopts site-based licensing, would it be in the public interest to license the bands individually and use separate applications for separate spectrum bands? The Commission recognizes that not all operators will seek authorization for all of the bands at issue. Moreover, even where an applicant seeks multiple frequency bands, the applicant may not have the same site or area of operation for each of the bands. Would separate licensing of separate bands be less burdensome and provide more flexibility for applicants than a single multi-band license application process, similar to space station and earth station licensing? Would some of the

differences in operational parameters be addressed more efficiently in a nationwide non-exclusive licensing application which would be coupled with a planned launch coordination registration? Are there any coordination issues in any of the frequency bands that would benefit from site licensing? Would it be simpler and less costly for the Commission to incorporate into the existing ULS or IBFS licensing processes and/or forms? What are the most efficient and effective way to license space launch operations that will provide operators with substantial benefits in terms of flexibility and efficiency, and will facilitate rapid implementation of this service?

54. To support the evolving communications needs of space launch entities and to provide flexibility sufficient to support innovation and investment in new technologies, the Commission seeks comment on how to allow applicants for space launch licenses to request authorization covering all launches within their license terms. The Commission also seeks comment on any measures needed to implement a multi-launch approach. For example, how should the Commission account for any variances in vehicle trajectory or spectrum usage from launch to launch? Should operators be required to file a modification or notification to change certain characteristics of their license, and if so, which characteristics? Which of these variances must be reflected in the license and which ones can be addressed during a planned launch coordination stage on a case-by-case basis? What information should be required to be provided at the licensing application stage and the planned launch stage?

55. If the Commission were to adopt a site-based licensing system for commercial space launch operations, under this proposal, applicants may request: (1) fixed stations on the ground, (2) mobile stations on the ground, and/or (3) stations on launch vehicles. For fixed ground site locations, each applicant would include in its application the specific coordinates for its proposed fixed sites. Because most space launch entities conduct launches at specific fixed sites, the Commission does not anticipate that providing this information will be burdensome. For mobile stations on the ground, each applicant would specify a mobile area of operation, as defined by a center point and radius governing their area of operation. Would this definition of mobile area of operation provide licensees the flexibility needed to support the existing and future needs of space launch entities? The Commission seeks comment on this proposed definition of mobile area of operation and on alternate definitions that might further its goals of providing flexibility to space launch operators while protecting other uses in the bands.

For example, should the mobile area of operation be defined by a specific county or some other metric, such as an option that allows the applicant to describe in text the proposed area of operation? For stations on launch vehicles, these stations can be authorized within a specific area of operation with a center point and radius coordinated and approved by an approved frequency coordinator. The Commission seeks comment on these proposals. The Commission further seeks comment on whether an applicant's ground stations in the United States should be licensed separately from the launch vehicle stations with which they are communicating, or whether those operations may be encompassed within a single license.

56. Launch vehicle operations can be categorized broadly into two take-off modes: a vertical take-off like a traditional launch vehicle or a horizontal take-off from a runway. In addition, launch vehicles can be either expendable or reusable. Further, an operator may seek to use different launch vehicles from launch to launch. The Commission seeks comment on whether the proposed site-based licensing framework and area of operation definitions will adequately accommodate all of these initial launch and reentry scenarios. To the extent that commenters believe that the proposals cannot be applied satisfactorily to all take-off, flight, and landing operations, the Commission requests comment on alternate licensing options or definitions. The Commission asks commenters to evaluate the costs and benefits of these proposals as well as alternatives or additional requirements that may be needed to improve the application process and to address the specific needs of the commercial space launch industry.

57. *ITU Process.* The Commission notes that the International Telecommunication Union (ITU) Radio Regulations are treaty provisions binding on the United States, and require that no transmitting station may be established or operated by a private person or by any enterprise without a license by or on behalf of the government of the country to which the station in question is subject. The Communications Act of 1934, as amended, provides the FCC with authority to take actions to implement the ITU Radio Regulations. The operations of the radio facilities on launch vehicles therefore must be authorized consistent with the ITU Radio Regulations. Because these operations could cause harmful interference in other countries, the Commission proposes to require applicants to submit appropriate draft documentation for submission to the ITU. The Commission seeks comment on this proposal and whether there are other alternatives, including bi-lateral coordination with affected countries, to coordinate and

minimize harmful interference from any FCC authorized space launch operation.

58. The Commission seeks comment more generally on the ITU process as it relates to space launch vehicle licensing and operations. In the space station context, operators provide information to the Commission for submission to the ITU as part of the space station application or authorization process. If the Commission were to decide to apply this process, the Commission seeks comment on how and when launch vehicle operators should provide it with information for submission to the ITU. One possibility would be an approach where launch vehicle applicants or licensees submit information to the Commission for an ITU submission regarding an upcoming planned launch a certain number of days prior to the planned launch. The Commission seeks comment on this approach and on alternatives. The Commission notes that this process is likely to vary depending on the licensing regime adopted, in particular on the scope of the license, such as whether a license covers multiple launches, including multiple launch trajectories. The Commission seeks comment on how the scope of the license should affect the applicant's submission of information for the ITU process.

59. *Space Launch Vehicle Operations Outside the United States.* The Commission observes that launch vehicle flight paths will commonly extend downrange beyond the U.S. territories, requiring the space launch vehicle to communicate with ground-based telemetry, tracking, and telecommand stations located outside of the United States, particularly in the 2025-2110 MHz and 2200-2290 MHz frequency bands. Such communications could be considered within the scope of a Part 87 authorization, for example, or be addressed by a licensing approach covering launch vehicles that would allow operations of such vehicles with ground stations both within and outside the U.S. territories, similar to a space station license under Part 25. The Commission seeks comment on these observations and the best way to authorize the use of the relevant spectrum bands to cover these operations.

60. The Commission seeks comment on whether it should view such launch vehicle operations as being authorized under the applicable site-based license subject to the requirement that such use is identified in the application and ITU coordination is completed. Or should such use be separately authorized? Would an alternative type of license better address operations with ground/earth stations outside the United States? The Commission notes that the ability of a launch vehicle operator to obtain ground station authorizations outside the United States may be dependent upon U.S. launch vehicle

licensing and/or ITU coordination and/or notification procedures, as needed. The Commission seeks comment on the various licensing approaches, given the need for down-range communications, and on the role that ITU coordination should have in the particular licensing approach.

61. *Operations Inside the United States with non-United States Space Launch Vehicles.* The Commission seeks comment on how the Commission should authorize ground station operations in the United States with space launch vehicles that are not authorized by the United States. For example, a space launch vehicle originating from a non-U.S. launch site and not otherwise authorized by the United States may seek to communicate with ground stations in the United States. Should the Commission adopt a process for ground station operators to request communications with these launch vehicles? For example, in the context of Part 25 satellite licensing, ground/earth station operators in the United States can apply for authority to communicate with non-U.S.-licensed space stations. In the space launch context, should applications be filed by the U.S. ground/earth station operators? And, if so, what information should be required?

62. *Alternative Approach.* The Commission also seeks comment on whether an authorization should be structured to cover all the bands allocated for commercial launch services, including operations outside the United States, discussed above. In other words, a single license application would be used to request multiple spectrum bands and associated uses on a single launch vehicle. For example, if a launch vehicle receives a flight termination signal in one frequency band and operates TT&C in a different frequency band, what are the costs and benefits to those operations being covered under a single space launch operations license? Would such an approach streamline our licensing processes or complicate them? What are the procedural and legal challenges that the Commission needs to consider with such a licensing approach? This approach also could be combined with the site-based or nationwide non-exclusive licensing approaches discussed above. Would such an approach serve the public interest? If the Commission were to adopt such an approach how can it be implemented? What licensing information should be required at the licensing application stage and the planned launch coordination stage? The Commission requests comment on these alternatives and seeks input on any other alternatives it should consider. The Commission asks that commenters discuss the impacts of a proposal, including associated administrative burdens or benefits.

63. *Frequency Coordination.* Frequency coordination minimizes the likelihood of interference between operations and facilitates the efficient use of spectrum. The Commission seeks comment on the appropriate coordination process between Federal and non-Federal users to be used prior to the grant of an application for space launch frequencies as well as a coordination process for the ongoing use of these frequencies by operators during their license terms.

64. As discussed in the *Report and Order*, the Commission shares licensing authority with NTIA. Section 301 establishes the Commission's licensing authority over non-Federal stations, and section 303 grants the Commission authority to "[m]ake such rules and regulations and prescribe such restrictions and conditions, not inconsistent with law, as may be necessary to carry out the provisions of this [Act.]". NTIA maintains licensing authority over Federal stations pursuant to section 305(a). The Commission and NTIA's shared licensing authority is guided by an established set of procedures for developing regulations for radio services in the shared bands and for authorizing frequency use by Federal agencies and Commission licensees.

65. These procedures, set forth under the Memorandum of Understanding (MOU) between NTIA and the Commission, require the agencies to endeavor to give notice to each other of "all proposed actions that could potentially cause interference" to non-Federal and Federal operations respectively. NTIA coordinates with Federal spectrum users through the Interdepartment Radio Advisory Council (IRAC), a committee that includes representation from different government agencies, and typically includes a review period of 15 business days.

66. Until the Commission adopts licensing and technical rules, the Commission will continue to coordinate STAs issued to commercial operators for space launch purposes with NTIA, pursuant to the MOU. Even after licensing and technical rules go into effect, the Commission will continue to have to pre-coordinate licenses with NTIA. Although the Commission is adopting one and proposing three other permanent non-Federal allocations for these bands, coordination is still required for use of these frequencies, given the potential for impacts to and from Federal users in these bands, as well as the potential for harmful interference among non-Federal users. The Commission therefore seeks input on a coordination procedure that will adequately minimize the potential for harmful interference, while also minimizing burdens on launch operators to the extent possible.

67. *Pre-grant coordination.* To help ensure that users in a band are protected from harmful interference, the Commission has incorporated various coordination requirements in its service rules, particularly in bands with shared use, in addition to the standard IRAC process. For example, applicants for flight test station licenses under Part 87, Subpart J are required to meet all applicable frequency coordination requirements. Section 87.305 requires that, prior to submission of an application to the Commission, a frequency advisory committee must coordinate all frequency requests with applicable Federal Government area frequency coordinators and provide recommendations regarding operating parameters. A flight test station application must include a frequency coordination statement from the frequency advisory committee, which includes a technical evaluation and recommendations to minimize interference. Once the application is submitted to the Commission, the request is then also submitted to NTIA for coordination, pursuant to the FCC and NTIA's MOU.

68. The Commission seeks comment on whether it should require applicants for a license in space launch frequencies to undergo a pre-application coordination requirement similar to that specified in § 87.305. This pre-application coordination requirement historically has been successful in minimizing the risk of harmful interference between flight test stations and other users of the band. Adopting a similar process may be helpful in the space launch context given the heavy usage of these bands by Federal entities as well as other space launch operators and the potential of interference to these operations. While it may, on first glance, seem that there is duplicative review, the pre-application coordination helps to narrow down the acceptable operating parameters of the use, thereby reducing administrative burdens and expediting review once the application is submitted. The Commission seeks comment on whether to apply this pre-application coordination process, or whether, in the alternative, it should impose a different coordination process.

69. In this regard, the Commission observes that Federal entities seeking to use the 2025-2110 MHz band for TT&C uplink purposes must complete a similar coordination process prior to submitting an application for authorization to NTIA. A Federal entity must coordinate with all BAS and other non-Federal incumbents that may be affected by the Federal operation prior to submitting an application, and must engage the local BAS frequency coordinator(s), where available, in support of achieving such coordination. To the extent that the Commission adopts a non-Federal allocation in the

2025-2110 MHz band for TT&C uplink purposes, it seeks comment on whether to require commercial space launch operators seeking to use the band to follow the same pre-application coordination process to help ensure that launch operations will not cause harmful interference to applicable non-Federal and Federal incumbents in the band. Alternatively, the Commission seeks comment as to whether it should apply a different pre-application coordination, such as the process identified in § 87.305.

70. If the Commission determines it would be in the public interest to adopt a pre-application coordination requirement, should the Commission appoint a designated frequency coordinator to streamline the coordination process? The Commission designated the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) as the frequency coordinating committee for non-Government flight test telemetry station assignments in the 1435-1535 MHz band and extended authority to the 2310-2320 MHz and 2345-2390 MHz bands. If the Commission decides to appoint a specific frequency coordinator, would it be in the public interest to extend AFTRCC's authority, or should the Commission appoint a different entity?

71. *Post-grant coordination.* Given that the license terms associated with permanent authorizations may span several years, the Commission seeks comment on coordination between space launch licensees and other users of the respective bands for separate launch operations. The Commission notes that experimental STAs are approved, and thereby coordinated, on a per launch basis. By contrast, the Part 87 flight test rules do not require additional formal coordination once an application has been granted. Given the complicated logistics entailed in a space launch operation, as well as changes in the operational environment on and around Federal ranges and other sites that are likely to occur over time, the Commission does not believe that a one-time coordination would be effective to cover all launches that occur during the term of an operator's license. At the same time, the Commission also wishes to avoid a coordination process that is overly burdensome for launch operators or that injects uncertainty as to spectrum access. The Commission requests that commenters propose solutions for this issue in their comments.

72. The Commission seeks comment on other coordination processes that are streamlined and efficient for space launch entities yet are also adequately protective of Federal operations and consistent with the provisions of the Commission and NTIA's MOU. The Commission asks that

commenters include detailed coordination procedures in their proposals, as well as the cost and benefits of the proposed process. The Commission notes that, given the importance in minimizing the potential for harmful interference to Federal and non-Federal uses alike in these bands, the Commission does not anticipate that coordination procedures would include a “shot clock”—*i.e.*, a provision that permits launch operators to move forward if review has not been completed by a certain date. The Commission seeks comment, however, on whether notification procedures could, under some circumstances or conditions, be sufficient to meet coordination requirements.

73. Technical Rules for Space Launch Operations. The Commission seeks comment on a proposed technical framework and on additional technical requirements for operations in the non-Federal allocations in the 2200-2290 MHz band and for operations in the proposed non-Federal allocations in the 420-430 MHz, 2025-2110, and 5650-5925 MHz bands. The Commission seeks to develop a technical framework and requirements that can address the unique needs of the commercial space sector.

74. The Commission’s goal in establishing a technical framework for commercial space launch operations is to develop rules that support the evolving interests and requirements of commercial space entities while minimizing harmful interference between Federal and non-Federal operations. The Commission finds that the current framework that applies to Federal operators offers a predictable and tested model that promotes the efficient use of spectrum while minimizing interference among users in these bands. The Commission therefore proposes to adopt a similar set of technical rules to non-Federal space launch operations in the newly allocated 2200-2290 MHz band as well as in the proposed allocations. The Commission finds that adopting a technical framework similar to that which currently applies to Federal operations will promote interoperability and allow commercial launch providers to benefit from the economies of scale inherent from using the same radio systems for both Federal agencies and commercial customers.

75. In the 2013 *Notice of Proposed Rulemaking*, the Commission sought comment generally on how to support the anticipated growth of the commercial space launch industry. The Commission asked whether providing non-Federal access to this spectrum would allow commercial space launch operators to incur lower development costs because they would be able to use the same communications systems for both Federal and non-Federal launches.

76. Several commenters support allocations and service rules that promote interoperability between Federal and commercial systems. For example, New Mexico Spaceport Authority (NMSA) maintains that interoperability between ranges avoids increased costs for development, hardware acquisition, operations, and testing; saves on opportunity costs; increases competition among launch providers and launch sites; and promotes the industry overall.

77. The Commission seeks comment on its proposal to model a technical framework on rules applicable to Federal launch operations. The Commission discusses below, as examples of this approach, certain technical requirements set forth in NTIA rules or ITU Radio Regulations and seeks comment on whether to apply similar rules to the 2200-2290 MHz band, as well as the proposed 420-430 MHz, 2025-2110 MHz, and 5650-5925 MHz allocations. The Commission seeks comment on other technical requirements that apply to Federal space launch operations in the relevant bands, such as any requirements regarding frequency tolerance, emissions classifications, or emissions levels, the benefits and costs of such requirements, whether the Commission should apply these requirements to non-Federal operations, and any additional technical rules needed to achieve its goals. For example, Table 5.2.1 of the NTIA Manual specifies frequency tolerance standards for aeronautical, space, and radiolocation stations in the frequencies at issue in this proceeding among others. The Commission seeks comment on adopting these or alternative frequency tolerance standards.

78. *2200-2290 MHz.* The 2200-2290 MHz band typically is used, in non-Federal space launch operations, for sending telemetry data from the launch vehicle to ground controllers. NTIA explains that Federal operations in the band primarily consist of tracking, telemetry, and control data communications for control of spacecraft. The band is used by Federal agencies in space operation, space research and Earth exploration-satellite service (space-to-Earth) for communications with earth stations and return links via TDRSS (space-to-space), which provides links between low earth orbiting spacecraft and earth stations. Federal agencies and the military also use this band for terrestrial telemetry operations for aircraft, missile flight testing, land and maritime mobile communications, and fixed point-to-point microwave relay communications.

79. As discussed above, the Commission has adopted a Space Operation allocation for the 2200-2290 MHz band and is also seeking comment on adopting a Mobile allocation in this band. As

space launch operations in this band may potentially operate under this dual regulatory approach, the Commission seeks comment on technical requirements under both a space operations and aeronautical mobile allocation, including whether these technical rules align with NTIA's requirements for both Federal and non-Federal space operations and how the Commission might promote consistency between and among the various, similarly situated services authorized in the band.

80. *Emission mask.* Under NTIA's space operations requirements, earth and space stations in the space operations service above 470 MHz must comply with the emissions mask standard established in section 5.6.2 of the NTIA Manual. Section 5.6.2 provides that for frequencies offset from the assigned frequency less than the 50 percent of the necessary bandwidth, no attenuation is required. At a frequency offset equal to 50 percent of the necessary bandwidth, an attenuation of at least 8 dB is required. Frequencies offset more than 50 percent of the necessary bandwidth should be attenuated in accordance with a specified formula dependent on necessary bandwidth and frequency displaced from the center of the emission bandwidth.

81. Section 5.3.9 of the NTIA Manual provides that aeronautical telemetry operation in the 2200-2290 MHz band must meet the emissions limits from Chapter 2 of the Inter-Range Instrumentation Group (IRIG) Standard 106-15, Part 1. Chapter 2 of IRIG Standard 106-15, Part 1 (hereinafter IRIG Standard 106-15), in turn, includes the following aeronautical telemetry spectral mask: all spectral components larger than $-[55 + 10\log(P)]$ dBc (*i.e.*, larger than -25 dBm) at the transmitter output must be within the spectral mask calculated using the following equation:

$$M(f) = K + 90 \log(R) - 100 \log |f-f_c|; |f-f_c| \geq R/m$$

where $M(f)$ = power (dBc) at frequency f (MHz)

$K = -20$ for analog signals

$K = -28$ for binary signals

$K = -61$ for FQPSK-B, FQPSK-JR, SOQPSK-TG

$K = -73$ for ARTM CPM

f_c = transmitter center frequency (MHz)

R = bit rate (Mbps) for digital signals or $(\Delta f + f_{\max})$ (MHz) for analog FM signals

M = number of states in modulating signal ($m = 2$ for binary signals, $m = 4$ for quaternary signals)

and analog signals)

Δf = peak deviation

f_{\max} = maximum modulation frequency

82. While the Commission seeks to align the technical parameters used by Federal and non-Federal operations to facilitate interoperability, it also seeks to introduce measures that will help licensees to simplify or streamline operations, while ensuring that other users in the band are protected. To that end, the Commission requests comment on the utility of using one specific mask for all non-Federal operations in the band as an alternative to NTIA's dual emissions mask approach. For example, the Commission seeks comment on applying the space operations emissions mask described above at all stages of flight, or whether alternatively the emission limits for space stations found in Part 25 should be applied. As another alternative, the Commission seeks comment on the use of the emission mask described in part 87 of the Commission's rules: (1) on any frequency removed from the assigned frequency by more than 50 percent, up to and including 100 percent of the authorized bandwidth, at least 25 decibels attenuation; (2) on any frequency removed from the assigned frequency by more than 100 percent, up to and including 250 percent of the authorized bandwidth, at least 35 decibels attenuation; and (3) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth, at least $43 + 10 \log(pY)$ decibels or 80 decibels, whichever is the lesser attenuation. The Commission seeks comment on these emission masks and whether such masks are appropriate notwithstanding our goal of promoting interoperability. Alternatively, the Commission seeks comment on whether to follow the NTIA approach of applying the aeronautical telemetry and space operations emission masks referenced by the NTIA Manual to first-stage and subsequent telemetry operations in the band, respectively, or any other alternatives.

83. *Power limits.* The RCC's IRIG Standard 106-15 that NTIA applies to aeronautical telemetry in the 2200-2290 MHz band provides that the EIRP of a transmitter shall not exceed 25 watts and that the output power shall not exceed 25 watts. NTIA's space operations requirements, in contrast, do not impose a power limit, and instead rely on a power flux-density limit. Consistent with the Federal requirements, the Commission seeks comment on whether to limit first-stage operations to an effective radiated power of 25 watts and a transmitter output power of up to 25 watts, and below, the Commission

seeks comment on whether to apply a power flux-density limit on operations after the first stage.

Alternatively, if the Commission adopts a power flux-density limit in the band, the Commission seeks comment on whether no further limit on power is necessary, or whether it should adopt an alternative to the power limit in IRIG Standard 106-15.

84. *Power flux-density limits applicable to second-stage operations.* The ITU Radio Regulations establish power flux-density limits at the surface of the Earth from space research, space operation and Earth exploration-satellite services in the 2025-2110 MHz and 2200-2290 MHz bands in order to protect the fixed and mobile services in those bands. These limits are reflected in section 8.2.36 of the NTIA Manual. The Commission seeks comment above on potentially treating commercial space operations in the band under both a mobile service and space operation service allocation framework. If the Commission adopts this approach, what should be the boundary between these regulatory frameworks for purposes of applying the ITU power-flux density limits? Should the ITU power flux-density limits apply when the launch vehicle is above a specified altitude, at a certain time after launch, at a particular stage of operation, or based on some other fashion on launch operations in the band? For example, the power flux-density limits could apply after 15 minutes of flight, or alternatively, could apply to either the second or subsequent stage of the launch vehicles operation. Would applying the power-flux density limit above a certain altitude better accommodate reentry operations as well? To the extent NTIA requires space launch operations to meet the PFD limit, at what stage of the launch (or at what demarcation point) does NTIA require compliance with the limit? Should the Commission adopt a parallel requirement in its technical rules? The Commission further seeks comment on whether, aside from the interest in harmonization, it should impose the power flux-density limit on operations in the 2200-2290 MHz band in a reference bandwidth of 1 megahertz instead of 4 kilohertz, consistent with Recommendation ITU-R SA.1273.

85. *420-430 MHz.* As noted, the 420-430 MHz band typically is used for sending flight termination commands from ground control to the launch vehicle, if necessary, during launch. Non-Federal entities may obtain access to this band through STAs. NTIA explains that the band is also used by the military and other Federal agencies for a number of important radar applications, multi-function position-location communications systems, and test range telecommand and flight termination systems,

making the band essential to national security.

86. The Commission recognizes that several commercial space launch entities have migrated or are in the process of migrating the flight termination signal from transmission of a signal from the ground station to launch vehicle to an automated function within the launch vehicles via onboard systems (*i.e.*, the flight termination sequence is now initiated from onboard the launch vehicle). Moreover, launches to date have occurred at Federal ranges, so access to this band by commercial launch providers has not been necessary. However, the Commission expects this to change as companies transition towards using commercial launch sites in the future. Therefore, adopting technical rules for commercial flight termination functions in the 420-430 MHz band is critical for ensuring the public is protected during space launches. To facilitate seamless operation with respect to Federal and non-Federal operations, the Commission seeks comment on whether to apply the same technical specifications for flight termination used by Federal space launches to non-Federal operations. For example, below, the Commission seeks comment on applying NTIA rules regarding emission mask and power limits.

87. *Emission mask.* NTIA requires land/mobile stations in the 420-430 MHz band to meet the standard established in section 5.2.2.2. This section requires that the mean power of any emission supplied to the antenna transmission line, as compared with the mean power of the fundamental, must be in accordance with the following: (a) on any frequency removed from the assigned frequency by more than 75 percent, up to and including 150 percent, of the authorized bandwidth, at least 25 decibels attenuation; (b) on any frequency removed from the assigned frequency by more than 150 percent, up to and including 300 percent, of the authorized bandwidth, at least 35 decibels attenuation; and (c) on any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth, two levels of attenuation depending on whether the transmitter operates with mean power of (1) less than 5 kilowatts or (2) 5 kilowatts or greater.

88. To facilitate similar treatment among non-Federal and Federal launches, the Commission proposes to apply an emission mask similar to section 5.2.2.2 to commercial launch operators using the 420-430 MHz band for flight termination purposes. The Commission seeks comment on the proposed emission mask. The Commission requests comment on alternative limits, and on the need for an emission mask generally for the transmission of this singular function.

89. *Power limits.* NTIA permits a maximum power limit of 1 kW of transmit power for range safety operations in the 420-450 MHz bands, which include flight termination operations such as self-destruct commands. Requests for additional power must be coordinated with and agreed to by the Commission. Range safety operations at three specific locations—Vandenberg AFB, CA; White Sands Missile Range, NM; and Cape Canaveral AFS, FL—may be authorized up to 10 kW transmit power without Commission coordination.

90. The Commission aims to provide flexibility to space launch operators using this band, but the Commission recognizes that limits are particularly necessary in this band, given that the intended use of this band is for safety-of-life applications. Consistent with the NTIA requirements, and with NTIA's stated preference for non-Federal launch operations in the band, the Commission proposes to permit an effective radiated power of up to 1000 watts by non-Federal launch providers. The Commission seeks comment on whether the proposed limits are sufficient to provide both the flexibility and the protection necessary to this safety-of-life application. The Commission also seeks comment on whether to consider alternative limits.

91. *2025-2110 MHz.* The 2025-2110 MHz band supports fixed and mobile services on a primary basis for non-Federal terrestrial use. The band is allocated to BAS and LTTS for fixed and mobile use and to CARS for mobile use only. Federal operations include communications with satellites or other space stations, as well as between satellites or spacecraft, occurring under primary allocations for space operations (Earth-to-space) (space-to-space), space research (Earth-to-space) (space-to-space), or Earth exploration-satellite service (Earth-to-space) (space-to-space). Federal agencies operate earth stations in this band for tracking and command of manned and unmanned Earth-orbiting satellites and space vehicles either for Earth-to-space links for satellites in all types of orbits or through space-to-space links using TDRSS. In addition, the National Oceanic and Atmospheric Administration (NOAA) operates earth stations in this band to control the Geostationary Operational Environmental Satellite (GOES) and Polar Operational Environmental Satellite (POES) meteorological satellite systems. To facilitate the relocation of military operations from the 2155-2180 MHz band, the 2025-2110 MHz band also includes a primary Federal allocation for fixed and mobile services, restricted to use by the military services and subject to certain provisions codified in footnote US92 of the U.S. Table.

92. *Emission mask.* The most analogous authorized Federal operation in the 2025-2110 MHz band is earth station telecommand transmissions to spacecraft, which operate under space operations rules. As discussed above, NTIA requires that earth and space stations in the space operations service above 470 MHz comply with the emissions mask standards established in section 5.6.2 of the NTIA Manual. Section 5.6.2 provides that for frequencies offset from the assigned frequency less than the 50 percent of the necessary bandwidth, no attenuation is required. At a frequency offset equal to 50 percent of the necessary bandwidth, an attenuation of at least 8 dB is required. Frequencies offset more than 50 percent of the necessary bandwidth should be attenuated in accordance with a specified formula dependent on necessary bandwidth and frequency displaced from the center of the emission bandwidth.

93. Consistent with the Commission's general approach, the Commission proposes to adopt the NTIA's emissions mask described above for commercial space launch transmissions in the 2025-2110 MHz band, except that the Commission proposes to apply attenuation requirements to the licensee's assigned frequencies rather than requiring a separate calculation of necessary bandwidth. The Commission seeks comment on this proposal, and on whether the Commission should adopt an alternative emissions mask.

94. *Power limits.* NTIA requires that the EIRP transmitted in any direction towards the horizon by a Federal earth station in bands between 1 GHz and 15 GHz that are shared with stations in the fixed or mobile service, which includes the 2025-2110 MHz band, shall not (with limited exceptions) exceed the following limits:

- +40 dBW in any 4 kHz band for $\theta \leq 0^\circ$
- $+40+3\theta$ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

95. Consistent with the Commission's general approach, the Commission proposes to adopt the NTIA's limit on maximum transmitted EIRP for commercial space launch transmissions in the 2025-2110 MHz band. The Commission seeks comment on this proposal, and on whether the Commission should adopt an alternative maximum power limit.

96. *5650-5925 MHz.* The 5650-5925 MHz band supports launch vehicle radar tracking. As noted, tracking of a launch vehicle typically involves use of a transponder that is placed on the launch vehicle. The transponder transmits a radar signal that is received at a ground-based tracking station. The radar signal provides ground controllers with more precise and accurate tracking information for the launch vehicle. NTIA explains that the Department of Defense (DoD) uses this band for a wide variety of radar applications, including anti-air warfare radars, which are part of an advanced ground-based air defense missile system. DoD and NASA also use this band for a variety of land-based and shipborne radars. The 5650-5925 MHz band also supports daily DoD and Department of Homeland Security (DHS) unmanned aircraft systems (UAS) missions.

97. Section 5.5 of the NTIA Manual contains the technical rules for Federal radar operations in the 5650-5925 MHz band. Section 5.5 provides five classifications of radar (Criteria A through E) incorporating NTIA's Radar Spectrum Engineering Criteria (RSEC). The RSEC establishes the technical standards for Federal radar use. Operations in the 5650-5925 MHz band are governed by RSEC Criteria A, RSEC Criteria B, or RSEC Criteria C, depending on the system characteristics and peak operating power of the radar system. RSEC Criteria A radars include radars with the following system characteristics: (1) non-pulsed radars of 40 watts or less rated average power; (2) pulsed radars of 1 kW or less rated peak power; (3) radars with an operating frequency above 40 GHz; and (4) expendable, non-recoverable radars on missiles. Criteria B applies if the radar system operates with a peak power over 1000 Watts and less than 100 kW. Criteria C applies if the system operates with less than 1000 Watts. The NTIA Manual also includes receiver standards.

98. *Emission mask.* To facilitate the interoperable use of tracking radar equipment, the Commission proposes that Commission licensees that plan to utilize the 5650-5925 MHz band for launch vehicle tracking will need to comply with the applicable RSEC requirements in the NTIA Manual. The NTIA Manual provides emission masks for RSEC Criteria A, RSEC Criteria B, and RSEC Criteria C. The Commission proposes to incorporate the emission masks listed in the NTIA Manual. The Commission seeks comment on this proposal and also request the submission of any alternative emission masks that may be applicable for operations in the band.

99. *Power limits.* While NTIA requires radar operations to meet RSEC technical

requirements, neither the RSEC requirements nor ITU Radio Regulations establish a specific power limitation for emissions inside the assigned bandwidth for radar operations in the 5650-5925 MHz band. However, the Commission notes that an ITU Recommendation, ITU-R M.1638-1, provides characteristics and sharing studies for certain radiolocation uses in the 5250-5850 MHz band that may be of use in helping to establish appropriate technical standards for radar tracking operations in the 5650-5925 MHz band. The Commission seeks comment on whether it is appropriate to derive power limits for operations in the 5650-5925 MHz band using parameters described in Recommendation ITU-R M.1638-1, specifically those found in Annex 1, Table 2, of the recommendation. The Commission seeks comment on appropriate limit(s) identified in the recommendation as well as alternative power levels.

100. *Accommodation of other services.* The Commission sought comment above on potential restrictions to the non-Federal radiolocation allocation in the 5650-5925 MHz band to enable coexistence with other operations in portions of this band. These other operations include the Intelligent Transportation Systems that operate in 5895-5925 MHz, U-NII devices that operate in 5650-5895 MHz, and fixed-satellite service uplinks that operate in 5850-5925 MHz. The Commission seeks comment on whether to adopt requirements or restrictions in the service rules for the radiolocation service to facilitate coexistence with these other operations. These may include, for example, limiting the portions of the band and/or locations where radiolocation operations may be conducted, restricting use of the radiolocation service only to transponders attached to launch vehicles, requiring coordination with these other operations, or limiting the power that radiolocation stations may transmit in the direction of the geostationary arc.

101. *2360-2395 MHz.* As noted in the NPRM, three frequencies in the 2360-2395 MHz band are available for both Federal and non-Federal telemetry and telecommand use for launch and reentry vehicles. This band is currently regulated under Subpart J of the Commission's Part 87 rules. As discussed in Section IV.B, one proposal is to create a separate subpart under the Part 87 rules for the commercial space launch operations under the non-Federal space operations allocation the Commission adopts today for the 2200-2290 MHz band. The Commission seeks comment on whether to administer the 2360-2395 MHz space launch use under this new subpart or whether to retain the Subpart J designation. If the Commission administers the 2360-2395 MHz space launch use under the new subpart,

should it apply the licensing scheme set forth under the new subpart or the existing licensing framework provided under the current Subpart J flight testing rules? In that event, should the Commission continue to apply the technical rules currently applicable to these services? Moreover, if the Commission continue to apply the Subpart J rules to the 2360-2395 MHz frequencies that may be used for space launch operations, should the Commission eliminate or amend any requirements under that subpart, including technical requirements such as power and emission limits, in light of other rule changes it proposes to adopt today? The Commission also notes that space launch telemetry and telecommand operations in the 2360-2395 MHz band occur under a Mobile allocation. In contrast, the Commission has adopted a Space Operation allocation for space launch telemetry operations in the 2200-2290 MHz band, while seeking comment on whether to add a Mobile allocation, and proposes to adopt a Space Operation allocation for space launch telecommand operations in the 2025-2110 MHz band. The Commission seeks comment on whether, to facilitate any changes it should make to the 2360-2395 MHz band space launch rules, it should add a primary Space Operation allocation to the band, limited to launch vehicle telemetry and associated telecommand operations, subject to the same restrictions as apply to such operations under the Mobile allocation as specified in footnote US276 of the U.S. Table.

102. While there has been substantial development of equipment for commercial space launches operating in the 2200-2290 MHz band, the Commission has very limited information on the state of commercial space launch equipment operating in the 2360-2395 MHz band. Accordingly, the Commission seeks comment on the current state of equipment development for commercial space launch purposes in the band. The Commission seeks comment on whether any such equipment that has equipment authorization now or is currently in development should be grandfathered from any rule changes it adopts for the 2360-2395 MHz band.

103. *Equipment Authorization.* Radio Frequency (RF) devices are required to be properly authorized under 47 CFR part 2 prior to being marketed or imported into the United States. Equipment that contains an RF device must be authorized in accordance with the appropriate procedures specified in 47 CFR part 2, subpart J, with certain limited exceptions. These requirements not only minimize the potential for harmful interference, but also ensure that the equipment complies with the rules that address other policy objectives—such as human RF exposure limits. The Commission has two different approval

procedures for equipment authorization—Certification and Supplier’s Declaration of Conformity (SDoC). The rule part governing the service under which the equipment operates may require that such equipment be authorized under SDoC or receive a grant of certification from a Telecommunication Certification Body. In some instances, a device may perform different functions under multiple rule parts, resulting in the device being subject to more than one type of approval procedure. Part 25, for example, requires equipment authorization for portable earth-station transceivers, *e.g.*, handsets, body-worn devices, antenna-in-keyboard notebook computers, as well as satellite digital audio radio service (SDARS) terrestrial repeaters and mobile-satellite service (MSS) ancillary terrestrial component (ATC) base stations and mobile transceivers. Part 87 generally requires certification for aviation services equipment, with limited exceptions such as flight test station transmitters for limited time periods. In the context of space launch operations, should the Commission require Part 2 equipment authorization for the radio frequencies devices that are being used to provide space launch operations and if so, which procedure is appropriate? Are there any additional or alternative compliance requirements or authorization processes specified in any of our rule parts, including Part 25, Part 87, or Part 90, that may be appropriate for space launch radio frequency devices or would provide analogous models for authorizing such equipment? What should such rules, if any, look like? Commenters should discuss cost and benefits of any proposed equipment authorization process and how such a process would serve the public interest while ensuring the equipment complies with the technical rules applicable to space launch operations.

104. *Licensing and Operating Rules for Payload Activities.* Although the primary focus of this proceeding is on radio-frequency use by space launch vehicles, space launch operations include launches of satellites and other commercial payloads. Accordingly, the Commission also seeks comment on whether there are improvements to the licensing process that could facilitate more routine licensing for certain payload activities currently addressed through experimental licensing. Launch payloads vary, from traditional geostationary and small satellites, to cargo capsules destined for the ISS, including the SpaceX Crew Dragon capsule transporting human crew to the ISS. Although most commercial payload needs for radiofrequency are addressed through the satellite licensing provisions in Part 25 of the Commission’s rules, there are some types of activities that are currently addressed through experimental licensing.

105. For example, involving some of the same frequency bands that are used for space launch activities, SpaceX's cargo and crew capsules utilize S-band frequencies. For links between the capsule and ground stations, SpaceX uses 2106 MHz (earth-to-space) and 2216 MHz (space-to-earth); SpaceX also uses 2203.2 MHz for links between the capsule and the ISS, 2028.78 MHz for links between the ISS and the capsule, 2287.5 MHz for links between the capsule and TDRSS, and 2106.4 MHz for TDRSS to the Capsule. In addition to SpaceX, another example is the Orbital Sciences Corporation, a Northrop Grumman Systems Corporation Affiliate, and its operations of the Cygnus spacecraft for transporting cargo to ISS, and deploying satellites. The Cygnus spacecraft has used 2287.5 (space-to-Earth) as well as 2287.5 MHz for links between the Cygnus spacecraft and TDRSS, and 2203.2 MHz for links between the Cygnus spacecraft and the ISS. The Commission seeks comment on how to establish frequency allocations and license processes to facilitate commercial space launch operations involving operations of payloads.

106. The Commission seeks comment on whether any changes to the Table of Frequency Allocations it is adopting or proposing herein for the 2025-2110 MHz and 2200-2290 MHz frequency bands are needed to provide for these payload communications. What are the spectrum requirements for such operations? Are there other frequency bands that the Commission should also consider for such uses? Recognizing that this use would also be subject to coordination with NTIA, are there additional technical provisions that would facilitate compatibility with existing Federal and other Non-Federal operations in these frequency bands?

107. In addition, the Commission seeks comment on whether such payload operations should be addressed in Part 25 of the Commission's rules. If so, as these newer commercial operations were not considered when many of the rules were first adopted, are there any modifications to the current Part 25 rules (e.g., default rules, bond requirements, fees, etc.) that may facilitate licensing? Would a streamlined process along the lines of the recently adopted process for small satellites be appropriate for such operations? Are there other licensing models that can be better suited for the needs of these payload operations?

108. The Commission is also aware of at least one launch operator, Rocket Lab, which intends to operate a spacecraft, derived from a launch vehicle upper stage, which will remain in orbit and function

as a payload, equipped with various radios and sensors designed for longer-term operations. One option to license such operation is to require the applicant to apply for both a launch operation license to cover the launch vehicle and a separate license for orbital insertion activities to cover subsequent payload activities, assuming the Commission decides to separate these activities and govern them under separate rule parts (*e.g.*, Part 87 for the launch activities and Part 25 for the payload activities). To that end, the Commission seeks comment on this proposal and on the point at which operations should be considered to have switched from launch vehicle operations to payload operations (*i.e.*, which operations should be covered by the Part 87 license and which by the Part 25 license). In addition, reentry operations may be necessary for certain payload vehicles, especially those transporting human crew. The Commission seeks comment on whether there should be distinct regulatory framework for such commercial payload transportation as well as the appropriate authorization approach for such reentry operations. Finally, are there other approaches the Commission should consider for licensing the radiofrequency operations of such objects?

109. In this *FNPRM*, the Commission separates issues associated with the licensing of commercial space launch operations into space launch vehicle communications operations (including space launch vehicle reentry) and payload communications operations—due to their distinct communications operations and underlying missions. The Commission believes that the telemetry, tracking, and command functions associated with the vehicle launch phase of a space launch are more akin to terrestrial aeronautical mobile and radiolocation operations under Parts 87 and 90, respectively, while the payload stage and associated communications may be more aptly viewed as space operations. Further, the Commission anticipates that operators may have different spectrum needs or seek to address them in different ways. Given these differences, are there any advantages of establishing separate licensing for these activities? Would such an approach provide space launch operators with greater flexibility to seek spectrum tailored to their operations? That said, the Commission seeks comment on other alternatives, including whether it would be appropriate and serve the public interest to license all phases of a commercial space operation under one authorization. The Commission seeks comment on the costs and benefits of such an authorization, including the possible consequences of issuing a single license to cover all aspects of a commercial launch operation and the associated administrative burdens and

benefits. For example, would consigning all necessary information under one authorization inadvertently complicate the application and licensing process given the disparate operations involved rather than streamlining or simplifying it? What are the procedural and legal challenges that the Commission needs to consider with such a licensing approach?

110. *Launch Vehicle-Satellite Communications.* While the new proposed licensing rules for space launch operations would support transmissions for TT&C between commercial space launch vehicles and ground stations, the Commission also seeks comment on authorizing communications between space launch vehicles and other space stations, including satellites. In some instances, the Commission observes that radios designed for communications with the Globalstar or Iridium satellite systems, for example, have been used on space launch vehicles in order to utilize those systems for data relay, including for TT&C purposes. The Commission seeks comment on whether such operations should continue to be licensed on an experimental or otherwise case-by-case basis, or whether these types of operations could be authorized as part of one of the approaches to space launch vehicle licensing discussed in this *FNPRM*. If commenters support authorization for such uses on a regular basis, are any changes needed to the Table of Frequency Allocations to provide for such operations? Are there existing frameworks from which the Commission could draw to authorize space launch vehicle to satellite communications through a footnote to the domestic Table of Frequency Allocations and appropriate additions or revisions to Part 25? What additional technical provisions would be needed to ensure compatibility with existing systems and services? Commenters proposing any licensing approaches should also discuss costs and benefits of such approaches, including associated administrative burdens or benefits, and how their proposals would ensure the most efficient and effective use of the spectrum in the public interest. For example, the Commission seeks comment on whether any proposed licensing approach for such operations would streamline the licensing processes or complicate them, and on the procedural and legal challenges that the need to be considered with such an approach.

111. *Expanded Federal Use of the non-Federal FSS and MSS Bands.* Over the past few years, U.S. space policies have evolved to encourage the Federal Government to use commercial space-related systems to meet its satellite communications needs through commercial leasing, which can include investment in Federal earth stations. However, current rules do not protect Federal earth station

investments when they are built to connect to commercial satellites. The FCC has collaborated with NTIA over many years on opportunities to provide greater parity between Federal and analogous non-Federal earth stations, recognizing that reliable satellite communications are vital for Federal agencies to accomplish their missions.

112. Nearly eight years ago, the *NPRM* sought comment on this issue. Specifically, the *NPRM* sought comment on a proposal to add a co-primary Federal FSS or MSS allocation to several bands together with a footnote that limits primary Federal use of the bands to earth stations communicating with non-Federal space stations. Alternatively, and in lieu of adding the new Federal allocations, the *NPRM* also sought comment on a proposal to add a footnote to the Table of Allocations outlining certain circumstances under which Federal earth stations operating with non-Federal space stations would be entitled to interference protection. The bands under consideration at that time included a wide range of non-Federal FSS and MSS allocations. The *NPRM* also proposed that for either approach, Federal agencies could operate earth stations in motion (ESIMs) on an interference protected basis to the same extent as non-Federal licensees. Under those proposals, Federal agencies would be expected to comply with all of the Part 25 rules pertaining to ESIMs and with the footnotes to the Allocation Table regarding ESIMs.

113. In the *NPRM*, the Commission noted that reliable access to spectrum for commercial launch operations and for federal earth stations were “two separate, but closely related portions of the commercial space sector.” Moreover, the National Space Policy has long recognized both of these issues as vital to continued progress in space. However, while the Commission advances its proposals regarding commercial launch operations in the *Order*, it notes that the spectrum landscape in non-Federal FSS and MSS allocations has changed significantly in the time since the *NPRM* was adopted. Our *Spectrum Frontiers*, *3.7 GHz Service*, *6 GHz* proceedings, among others, have altered the underlying assumptions about current and expected future uses of many of the frequency bands that were discussed in the *NPRM* and the subsequent record. Some of the bands under consideration in the *NPRM* may no longer be appropriate candidates for expanded Federal FSS or MSS use given recent changes in the FCC’s licensing or technical rules for the band. Other bands, however, may support greater Federal use.

114. The Commission recognizes again the need for greater parity and certainty in the

protections granted to communications between commercial satellites and Federal users. However, the Commission must give careful consideration to the *NPRM*'s proposals based on the current state of the commercial satellite marketplace. Accordingly, the Commission seeks to refresh the record with respect to the *NPRM*, which sought comment on expanded Federal use of the 4.0-4.2 GHz, 5.925-6.425 GHz, 11.7-12.2 GHz, 13.75-14.5 GHz, 18.3-19.3 GHz, 19.7-20.2 GHz, 28.35-29.1 GHz, and 29.25-30 GHz frequency bands, among others. The Commission plans to move expeditiously in reviewing and acting on this new record.

115. Some of the bands raised in the *NPRM* may no longer be suitable for expanded federal use. In the *3.7 GHz Report and Order* the Commission established a new 3.7 GHz Service for terrestrial operations in the 3.7-3.98 GHz band and established a transition process for existing non-federal operators in the 3.7-4.2 GHz band. The transition process included protection criteria for existing registered incumbent operators that would continue to operate FSS earth stations in the 4.0-4.2 GHz portion of the band after the transition. At that time, the Commission also found that it would not be in the public interest to allow non-federal operators to register new protected earth stations in the 4.0-4.2 GHz band. Since that time, the Commission completed Auction 107 and announced winning bids totaling a record \$81.1 billion in gross bids. Similarly, the Commission recently adopted rules to permit greater use by unlicensed devices of the 5.925-6.425 GHz band, which is the uplink band paired with the 3.7-4.2 GHz downlink band. The Commission has proposed to further expand unlicensed use of this band. Do commenters agree with the Commission's observation that, given the current status of these bands, they may not be suitable candidates for expanded federal use?

116. In the *NPRM*, the Commission noted that terrestrial services heavily use several segments of the extended Ku-band, including the 10.7-11.7 GHz and 12.7-13.25 GHz bands, and therefore the Commission, at the time, "[did] not anticipate that the [extended Ku-] band will be heavily used by Federal agencies." Does this remain the case? Does the complexity of coordination between terrestrial and satellite users in these bands outweigh the benefits of expanding Federal users' access to these frequencies? Are there other frequency bands included in the *NPRM* that should be considered further? Which of the two alternative *NPRM* proposals for providing Federal access to these bands—adopting a Federal allocation or providing Federal earth stations interference protection through a footnote—is

preferable? Are any additional modifications required to either set of proposals with respect to any relevant frequency bands, including whether to include a secondary allocation instead of a co-primary allocation or provide some other means of providing interference protection to Federal earth stations, communicating with non-Federal satellites? What process should the Commission, NTIA, and Federal agencies follow when coordinating Federal earth stations in the relevant bands to receive protection? Should the fact that the Commission has licensed non-geostationary satellite systems with large numbers of satellites in some of these bands since the *NPRM* was issued impact our decision? Is there a need for the Commission to address Federal access to satellite bands where its rules permit blanket licensing of earth stations, such as the Ku-band and Ka-band, as blanket licensing permits Federal agencies to access commercial satellite systems on what effectively amounts to an equal basis with Commission licensees? Finally, to the extent that certain parties may be concerned about how such proposals, if implemented, might inhibit future repurposing of these bands for other non-federal services, the Commission seeks comment on those concerns and ways to address them.

117. *Federal Space Stations in the 399.9-400.05 MHz MSS Band.* Currently, U.S. Table footnote US319 prevents Federal space stations from operating in the 399.9-400.05 MHz band even though there is a primary Federal MSS allocation for this band. At the request of NTIA, the *NPRM* proposed to permit Federal space stations (*i.e.*, satellites) to operate in this band. The Commission takes this opportunity to invite further comment on the *NPRM*'s proposal to modify footnote US319 to permit Federal space stations to operate in the 399.9-400.05 MHz band.

118. NTIA made this request to allow the 399.9-400.05 MHz band be used for a new satellite system that will assume some of the traffic currently handled by the Argos satellite system. Argos is a satellite system that was established by the French Space Agency, NASA, and the National Oceanic and Atmospheric Administration (NOAA). Argos is used for a large number of applications, such as monitoring the oceans at thousands of fixed and drifting buoys, tracking the movements of wildlife, relaying information by humanitarian agencies from remote areas, monitoring water resources, and tracking the locations of ships. According to NTIA, establishing a new satellite system in the 399.9-400.05 MHz band would allow non-environmental applications to be removed from the Argos system which will result in lower interference, higher capacity, and improved reliability and service for both the

environmental applications remaining on Argos and the non-environmental applications moved to the new system.

119. The Commission first made the 399.9-400.05 MHz band along with three other frequency bands available for MSS in 1993 to allow deployment of non-geosynchronous low Earth orbit (LEO) satellite systems, called “Little LEO” systems, to provide non-voice services such as data messaging and position determination. Although a Little LEO system had been deployed in other nearby frequency bands, at the time that the *NPRM* was adopted in 2013 no MSS applicants had requested access to the band. In 2019, the Commission’s International Bureau initiated a processing round for non-voice non-geostationary systems in this band as well as the 400.15-401 MHz band. Five applications were included in this processing round. The Commission’s International Bureau has granted market access for the 399.9-400.05 MHz band to two of these applicants while the other applications remain pending.

120. The only commenter to address the 399.9-400.05 MHz band in response to the *NPRM* was Bigelow Aerospace. Bigelow Aerospace suggested that the 399.9-400.05 MHz band be allocated for emergency audio/data and backup communications links for communications between manned space stations or spacecraft and earth stations. Bigelow Aerospace made this suggestion as part of a discussion of the future bandwidth needs of crewed space stations and spacecraft that included suggestions that numerous other bands be used for different communication purposes. Bigelow Aerospace did not address the merits of NTIA’s request to open up this band to Federal space stations.

121. The Commission seeks additional comment on the *NPRM*’s proposal to amend footnote US319 to permit Federal space stations in the 399.9-400.05 MHz band. As indicated by the number of applications the Commission has received to use the band for NVNG MSS operations, the interest in use of the band has significantly changed since the record was developed in response the *NPRM*. Considering these changes, the Commission seeks to update the record on this issue and on whether modifying footnote US319 to permit Federal space stations to operate in the 399.9-400.05 MHz band would serve the public interest. Allocating spectrum for a new satellite system to supplement Argos may further the reliable provision of important services. However, any Federal satellites in this band will need to coexist with the non-Federal systems to also be deployed in the band. The Commission seeks comment on how this spectrum band can be shared by Federal systems without causing harmful interference to non-Federal

systems, including those in the adjacent bands, and if coordination between the relevant systems can resolve any potential interference issues.

122. *Future Needs of the Commercial Space Industry.* In the Notice of Inquiry (*NOI*) accompanying the *NPRM*, the Commission launched an inquiry into the future spectrum requirements of the commercial space industry. The *NOI* sought comment broadly on what other spectrum needs may be important as the commercial space sector continues to develop, including the spectrum requirements for commercial spaceports, the communications needs for other portions of space missions after the launch, and the portions of the Commission's rules that may need to be amended to keep pace with this rapidly changing industry. Therefore, the Commission seeks further comment on these issues and any additional information, data, and proposals that might be relevant to determine current and future spectrum and communications needs of the commercial space industry to facilitate innovations and the sustainability of space exploration and development.

PROCEDURAL MATTERS

123. *Ex Parte Presentations.* The proceeding shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules. Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must: (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing

oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

124. *Comment Period and Filing Procedures.* Pursuant to §§ 1.415 and 1.419 of the Commission's rules, 47 CFR 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs/>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing.
 - Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
 - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
 - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street, NE, Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. *See FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy*, Public Notice, DA 20-304 (March 19, 2020), <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.
- During the time the Commission's building is closed to the general public and until further notice, if more than one docket or rulemaking number appears in the caption

of a proceeding, paper filers need not submit two additional copies for each additional docket or rulemaking number; an original and one copy are sufficient.

- After COVID-19 restrictions are lifted, the Commission has established that hand-carried documents are to be filed at the Commission's office located at 9050 Junction Drive, Annapolis Junction, MD 20701. This will be the only location where hand-carried paper filings for the Commission will be accepted.

125. *People with Disabilities.* To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

126. *Initial Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities of the proposals addressed in this *Notice of Proposed Rulemaking*. The IRFA is set forth in Appendix E of this *Further Notice of Proposed Rulemaking*. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines for comments on the *Further Notice of Proposed Rulemaking*, and should have a separate and distinct heading designating them as responses to the IRFA. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this *Further Notice of Proposed Rulemaking*, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with the Regulatory Flexibility Act.

127. *Paperwork Reduction Act Analysis.* This *Further Notice of Proposed Rulemaking* contains proposed modified information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4)), the Commission seeks specific comment on how it might further reduce the information collection burden for small business concerns with fewer than 25 employees.

ORDERING CLAUSES

128. Accordingly, IT IS ORDERED that, pursuant to sections 1, 2, 4(i), 5(c), 301, 303(c), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. 151, 152, 154(i), 155(c), 301, 303(c), 303(f), and 303(r), and § 1.411 of the Commission's rules, 47 CFR 1.411, this *Report and Order and Further Notice of Proposed Rulemaking* IS HEREBY ADOPTED.

129. IT IS FURTHER ORDERED that the amendments of part 2 of the Commission's rules, as set forth in Appendix A of the *Report and Order and Further Notice of Proposed Rulemaking*, ARE ADOPTED, effective thirty (30) days after publication in the *Federal Register*.

130. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *Report and Order and Further Notice of Proposed Rulemaking*, including the Final and Initial Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

131. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of this *Report and Order* in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene Dortch,

Secretary.

List of Subjects

47 CFR Part 2

Communications equipment, Radio, Telecommunications.

47 CFR Part 87

Communications equipment, Radio.

47 CFR Part 90

Communications equipment, Radio, Telecommunications.

Proposed Rules

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 CFR parts 2, 87, and 90 as follows:

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation for part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended by:

- a. Revising pages 26, 28, 36, 37, 43, and 44; and

- b. In the list of United States (US) Footnotes:

- i. Adding footnote US68;

- ii. Revising footnote US96;

- iii. Adding footnote US121; and

- iv. Revising footnote US319.

The revisions and additions read as follows:

§ 2.106 Table of Frequency Allocations.

* * * * *

272-273 SPACE OPERATION (space-to-Earth) FIXED MOBILE			
5.254			
273-312 FIXED MOBILE			
5.254			
312-315 FIXED MOBILE Mobile-satellite (Earth-to-space) 5.254 5.255			
315-322 FIXED MOBILE			
5.254	G27 G100		
322-328.6 FIXED MOBILE RADIO ASTRONOMY	322-328.6 FIXED MOBILE	322-328.6	
5.149	US342 G27	US342	
328.6-335.4 AERONAUTICAL RADIONAVIGATION 5.258	328.6-335.4 AERONAUTICAL RADIONAVIGATION 5.258		Aviation (87)
5.259			
335.4-387 FIXED MOBILE	335.4-399.9 FIXED MOBILE	335.4-399.9	
5.254			
387-390 FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255			
390-399.9 FIXED MOBILE			
5.254	G27 G100		
399.9-400.05 MOBILE-SATELLITE (Earth-to-space) 5.209 5.220	399.9-400.05 MOBILE-SATELLITE (Earth-to-space) US320 RADIONAVIGATION-SATELLITE		Satellite Communications (25)
400.05-400.15 STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz)	400.05-400.15 STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz)		
5.261 5.262	5.261		

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420-430 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271			420-430 Amateur US270 US64 US68 US230 US269	Private Land Mobile (90) MedRadio (95I) Amateur Radio (97)	
430-432 AMATEUR RADIOLOCATION	430-432 RADIOLOCATION Amateur				430-450 Amateur US270 MedRadio (95I) Amateur Radio (97)
5.271 5.274 5.275 5.276 5.277	5.271 5.276 5.277 5.278 5.279				
432-438 AMATEUR RADIOLOCATION Earth exploration-satellite (active) 5.279A	432-438 RADIOLOCATION Amateur Earth exploration-satellite (active) 5.279A				
5.138 5.271 5.276 5.277 5.280 5.281 5.282	5.271 5.276 5.277 5.278 5.279 5.281 5.282				
438-440 AMATEUR RADIOLOCATION	438-440 RADIOLOCATION Amateur				
5.271 5.274 5.275 5.276 5.277 5.283	5.271 5.276 5.277 5.278 5.279				
440-450 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286			5.286 US64 US68 US87 US230 US269 US270 US397 G8	5.282 5.286 US64 US87 US269 US397	
450-455 FIXED MOBILE 5.286AA			450-454 LAND MOBILE	Remote Pickup (74D) Low Power Auxiliary (74H) Private Land Mobile (90) MedRadio (95I)	
			5.286 US64 US87	5.286 US64 US87 NG112 NG124	
5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E			454-456	454-455 FIXED LAND MOBILE US64 NG32 NG112 NG148	Public Mobile (22) Maritime (80) MedRadio (95I)
455-456 FIXED MOBILE 5.286AA	455-456 FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.286A 5.286B 5.286C	455-456 FIXED MOBILE 5.286AA	US64	455-456 LAND MOBILE	Remote Pickup (74D) Low Power Auxiliary (74H) MedRadio (95I)
5.209 5.271 5.286A 5.286B 5.286C 5.286E	5.209	5.209 5.271 5.286A 5.286B 5.286C 5.286E		US64	

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1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	5.289 5.341	5.341 US88	
1710-1930 FIXED MOBILE 5.384A 5.388A 5.388B		1710-1761 5.341 US91 US378 US385 1761-1780 SPACE OPERATION (Earth-to-space) G42 US91	1710-1780 FIXED MOBILE 5.341 US91 US378 US385	
		1780-1850 FIXED MOBILE SPACE OPERATION (Earth-to-space) G42	1780-1850	
5.149 5.341 5.385 5.386 5.387 5.388		1850-2025	1850-2000 FIXED MOBILE	RF Devices (15) Personal Communications (24) Wireless Communications (27) Fixed Microwave (101)
1930-1970 FIXED MOBILE 5.388A 5.388B	1930-1970 FIXED MOBILE 5.388A 5.388B Mobile-satellite (Earth-to-space)	1930-1970 FIXED MOBILE 5.388A 5.388B		
5.388	5.388	5.388		
1970-1980 FIXED MOBILE 5.388A 5.388B				
5.388				
1980-2010 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.388 5.389A 5.389B 5.389F				
2010-2025 FIXED MOBILE 5.388A 5.388B	2010-2025 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	2010-2025 FIXED MOBILE 5.388A 5.388B	2000-2020 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	Satellite Communications (25) Wireless Communications (27)
5.388	5.388 5.389C 5.389E	5.388	2020-2025 FIXED MOBILE	
2025-2110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space)		2025-2110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) SPACE RESEARCH (Earth-to-space) (space-to-space) FIXED MOBILE 5.391	2025-2110 SPACE OPERATION (Earth- to-space) (space-to-space) FIXED NG118 MOBILE 5.391	Satellite Communications (25) TV Auxiliary Broadcasting (74F) Cable TV Relay (78) Local TV Transmission (101J)
5.392		5.392 US90 US92 US222 US346 US347	5.392 US90 US92 US222 US346 US347	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
2110-2120 FIXED MOBILE 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space) 5.388			2110-2120 US252	2110-2120 FIXED MOBILE US252	Public Mobile (22) Wireless Communications (27) Fixed Microwave (101)
2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2160 FIXED MOBILE 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2200	2120-2180 FIXED MOBILE	
	2160-2170 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.388 5.389C 5.389E			NG41 2180-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25) Wireless Communications (27)
5.388 2170-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F		5.388			
2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)			2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED (line-of-sight only) MOBILE (line-of-sight only including aeronautical telemetry, but excluding flight testing of manned aircraft) 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space) 5.392 US303 US96	2200-2290 US96 US303	
5.392 2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)			2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	2290-2300 SPACE RESEARCH (deep space) (space-to-Earth)	
2300-2450 FIXED MOBILE 5.384A Amateur Radiolocation	2300-2450 FIXED MOBILE 5.384A RADIOLOCATION Amateur		2300-2305 G122 2305-2310	2300-2305 Amateur 2305-2310 FIXED MOBILE except aeronautical mobile RADIOLOCATION Amateur US97	Amateur Radio (97) Wireless Communications (27) Amateur Radio (97)

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International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
5460-5470 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION 5.448D RADIONAVIGATION 5.449 SPACE RESEARCH (active)			5460-5470 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 RADIONAVIGATION 5.449 US65 SPACE RESEARCH (active)	5460-5470 RADIONAVIGATION 5.449 US65 Earth exploration-satellite (active) Radiolocation Space research (active)	Maritime (80) Aviation (87) Private Land Mobile (90)
5.448B			5.448B US49 G130	5.448B US49	
5470-5570 EARTH EXPLORATION-SATELLITE (active) MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B MARITIME RADIONAVIGATION SPACE RESEARCH (active)			5470-5570 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 MARITIME RADIONAVIGATION US65 SPACE RESEARCH (active)	5470-5570 RADIOLOCATION MARITIME RADIONAVIGATION US65 Earth exploration-satellite (active) Space research (active)	RF Devices (15) Maritime (80) Private Land Mobile (90)
5.448B 5.450 5.451			5.448B US50 G131	US50	
5570-5650 MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B MARITIME RADIONAVIGATION			5570-5600 RADIOLOCATION G56 MARITIME RADIONAVIGATION US65 US50 G131	5570-5600 RADIOLOCATION MARITIME RADIONAVIGATION US65 US50	
			5600-5650 METEOROLOGICAL AIDS RADIOLOCATION G56 MARITIME RADIONAVIGATION US65	5600-5650 METEOROLOGICAL AIDS RADIOLOCATION MARITIME RADIONAVIGATION US65	
5.450 5.451 5.452			5.452 US50 G131	5.452 US50	
5650-5725 MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION Amateur Space research (deep space)			5650-5925 RADIOLOCATION US121 G2	5650-5830 Amateur	RF Devices (15) ISM Equipment (18) Amateur Radio (97)
5.282 5.451 5.453 5.454 5.455					
5725-5830 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur	5725-5830 RADIOLOCATION Amateur				
5.150 5.451 5.453 5.455	5.150 5.453 5.455			5.150 5.282 US121	
5830-5850 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)	5830-5850 RADIOLOCATION Amateur Amateur-satellite (space-to-Earth)			5830-5850 Amateur Amateur-satellite (space-to-Earth)	
5.150 5.451 5.453 5.455	5.150 5.453 5.455			5.150 US121	

5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation		5850-5925 FIXED-SATELLITE (Earth-to-space) US245 MOBILE NG160 Amateur	RF Devices (15) ISM Equipment (18) Private Land Mobile (90) Personal Radio (95) Amateur Radio (97)
5.150	5.150	5.150	5.150 US245	5.150 US121	
5925-6700 FIXED 5.457 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C			5925-6425	5925-6425 FIXED FIXED-SATELLITE (Earth-to-space) NG457A	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
			6425-6525	6425-6525 FIXED-SATELLITE (Earth-to-space) MOBILE	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
			5.440 5.458 6525-6700	5.440 5.458 6525-6700 FIXED FIXED-SATELLITE (Earth-to-space)	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
5.149 5.440 5.458 6700-7075 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE			5.458 US342 6700-7125	5.458 US342 6700-6875 FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 5.458 5.458A 5.458B	
				6875-7025 FIXED NG118 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE NG171 5.458 5.458A 5.458B	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
5.458 5.458A 5.458B 7075-7145 FIXED MOBILE				7025-7075 FIXED NG118 FIXED-SATELLITE (Earth-to-space) NG172 MOBILE NG171 5.458 5.458A 5.458B 7075-7125 FIXED NG118 MOBILE NG171	RF Devices (15) TV Broadcast Auxiliary (74F) Cable TV Relay (78)
			5.458 7125-7145 FIXED	5.458 7125-7145	RF Devices (15)
5.458 5.459			5.458 G116	5.458	

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UNITED STATES (US) FOOTNOTES

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US68 The band 420-430 MHz is allocated to the aeronautical mobile service on a primary basis for non-Federal use. Non-Federal stations in the aeronautical mobile service shall be:

- (a) Restricted to use for pre-launch testing of launch vehicles and sending flight termination signals to launch vehicles during launches; and
- (b) Subject to coordination with NTIA prior to each launch.

* * * * *

US96 The band 2200-2290 MHz is allocated to the space operation (space-to-Earth) and the mobile services on a secondary basis for non-Federal use. Non-Federal stations in the space operation and mobile services shall be:

- (a) Restricted to use for pre-launch testing and space launch operations except as provided under US303; and
- (b) Subject to coordination with NTIA prior to each launch.

* * * * *

US121 The band 5650-5925 MHz is allocated to the radiolocation service on a primary basis for non-Federal use. Non-Federal stations in the radiolocation service shall be:

- (a) Restricted to use for pre-launch testing and tracking launch vehicles; and
- (b) Subject to coordination with NTIA prior to each launch.

* * * * *

US319 In the bands 137-138 MHz, 148-149.9 MHz, 149.9-150.05 MHz, 400.15-401 MHz, 1610-1626.5 MHz, and 2483.5-2500 MHz, Federal stations in the mobile-satellite service shall be limited to earth stations operating with non-Federal space stations.

* * * * *

PART 87 – AVIATION SERVICES

3. The authority citation for part 87 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303 and 307(e), unless otherwise noted.

4. Add subpart U, consisting of §§ 87.601 through 87.606, to read as follows:

Subpart U—Commercial Space Launch Stations

Sec.

87.601 Scope of service.

87.602 Supplemental eligibility.

87.603 Frequencies.

TECHNICAL REGULATIONS GOVERNING THE USE OF 420-430 MHz, 2025-2110 MHz, AND 2200-2290 MHz BANDS

87.604 Frequency coordination.

87.605 Emission masks.

87.606 Power limits.

Subpart U—Commercial Space Launch Stations

§ 87.601 Scope of service.

Commercial space launch stations are restricted to the following uses:

- (a) *420-430 MHz band.* The use of commercial space launch licenses in the 420-430 MHz band is restricted to the transmission of flight termination signals during pre-launch testing and launch operations.
- (b) *2025-2110 MHz band.* The use of commercial space launch licenses in the 2025-2110 MHz band is restricted to telecommand uplink transmissions from the controllers on the ground to the launch vehicle.
- (c) *2200-2290 MHz band.* The use of commercial space launch licenses in the 2200-2290 MHz band is restricted to the transmission of telemetry data from the launch vehicle to controllers on the ground.

§ 87.602 Supplemental eligibility.

(a) The following entities are eligible for commercial space launch licenses:

- (1) An operator or manufacturer of commercial spacecraft or spacecraft components;
- (2) A parent corporation or its subsidiary if either corporation is an operator or manufacturer of spacecraft or spacecraft components; or
- (3) An educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of spacecraft or spacecraft components.

(b) Each application must include a certification sufficient to establish the applicant's eligibility under the criteria in paragraph (a) of this section.

§ 87.603 Frequencies.

Commercial space launch operations are conducted in the 420-430 MHz, 2025-2110 MHz, and 2200-2290 MHz bands on a co-equal basis with U.S. Government stations. Frequencies in the 420-430 MHz, 2025-2110 MHz, and 2200-2290 MHz bands are assigned for telemetry and telecommand operations of expendable and re-usable launch vehicles:

(a) *420-430 MHz*. Frequencies in the 420-430 MHz band are assigned on a shared basis for the transmission of flight termination signals during pre-launch testing and launch operations.

(b) *2025-2110 MHz*. Frequencies in the 2025-2110 MHz band are assigned on a shared basis for telecommand uplink transmissions from the controllers on the ground to the launch vehicle.

(c) *2200-2290 MHz*. Frequencies in the 2200-2290 MHz band are assigned on a shared basis for the transmission of telemetry data from the launch vehicle to controllers on the ground.

TECHNICAL REGULATIONS GOVERNING THE USE OF 420-430 MHz, 2025-2110 MHz, AND 2200-2290 MHz BANDS

§ 87.604 Frequency coordination.

(a) (1) Each application for a new station license, renewal, or modification of an existing license concerning commercial space launch frequencies, except as provided in paragraph (b) of this section, must be accompanied by a statement from a frequency advisory committee. The committee must comment on the frequencies requested or the proposed changes in the authorized station and the probable interference to existing stations. The committee must consider all stations operating on the frequencies requested or assigned within 320 km (200 mi) of the proposed area of operation and all prior coordinations and assignments on the proposed frequency(ies). The committee must also recommend frequencies resulting in the minimum interference. The committee must coordinate in writing all requests for frequencies or proposed operating changes with the responsible Government Area Frequency Coordinators listed in the NTIA “Manual of Regulations and Procedures for Federal Radio Frequency Management.” In addition, committee recommendations may include comments on other technical factors and may contain recommended restrictions which it believes should appear on the license.

(2) The frequency advisory committee must be organized to represent all persons who are eligible for

non-Government space launch stations. A statement of the organization service area and composition of the committee must be submitted to the Commission for approval. The functions of any advisory committee are purely advisory to the applicant and the Commission, and its recommendations are not binding upon either the applicant or the Commission.

(b) These applications need not be accompanied by evidence of frequency coordination:

(1) Any application for modification not involving change in frequency(ies), power, emission, antenna height, antenna location, or area of operation.

(2) [Reserved]

§ 87.605 Emission masks.

(a) *420-430 MHz.* The mean power of any emission supplied to the antenna transmission line, as compared with the mean power of the fundamental, in the 420-430 MHz band of the Commercial Space Launch Service must be in accordance with the following:

(1) On any frequency removed from the assigned frequency by more than 75 percent, up to and including 150 percent, of the authorized bandwidth, at least 25 decibels attenuation;

(2) On any frequency removed from the assigned frequency by more than 150 percent, up to and including 300 percent, of the authorized bandwidth, at least 35 decibels attenuation; and

(3) On any frequency removed from the assigned frequency by more than 300 percent of the authorized bandwidth, two levels of attenuation depending on whether the transmitter operates with mean power of:

(i) Less than 5 kilowatts; or

(ii) 5 kilowatts or greater.

(b) *2025-2110 MHz.* For frequencies offset from the assigned frequency less than the 50 percent of the necessary bandwidth, no attenuation is required. At a frequency offset equal to 50 percent of the necessary bandwidth, an attenuation of at least 8 dB is required. Frequencies offset more than 50 percent of the necessary bandwidth shall be attenuated in accordance with a specified formula dependent on necessary bandwidth and frequency displaced from the center of the emission bandwidth.

(c) *2200-2290 MHz.* All spectral components larger than $-[55 + 10 \log(P)]$ dBc (*i.e.*, larger than -25 dBm) at the transmitter output must be within the spectral mask calculated using the following equation:

$$M(f) = K + 90 \log(R) - 100 \log |f - f_c| \text{ Eqn. A-9}$$

where $M(f)$ = power (dBc) at frequency f (MHz)

$K = -20$ for analog signals

$K = -28$ for binary signals

$K = -61$ for FQPSK-B, FQPSK-JR, SOQPSK-TG

$K = -73$ for ARTM CPM

f_c = transmitter center frequency (MHz)

R = bit rate (Mbps) for digital signals or $(\Delta f + f_{\max})$ (MHz) for analog FM signals

M = number of states in modulating signal ($m = 2$ for binary signals, $m = 4$ for quaternary signals and analog signals)

f = peak deviation

f_{\max} = maximum modulation frequency

§ 87.606 Power limits.

(a) *420-430 MHz.* The effective radiated power of a transmitter in the 420-430 MHz band of the Space Operation Service shall not exceed 1000 Watts.

(b) *2025-2110 MHz.* The effective radiated power of a transmitter in the 2025-2110 MHz band of the Space Operation Service shall not (with limited exceptions) exceed the following limits:

- (i) +40 dBW in any 4 kHz band for $\theta \leq 0^\circ$
- (ii) +40+3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

(c) *2200-2290 MHz.* The effective radiated power of a transmitter in the 2200-2290 MHz band of the Space Operation Service shall not exceed 25 Watts and the transmitter output power shall not exceed 25 Watts. In addition, the power flux-density at the Earth's surface produced by emissions from a transmitter operating after the first stage for all conditions and for all methods of modulation shall not exceed the following limits:

–154 dB(W/m²) in any 4 kHz for angles of arrival less than 5° above the horizontal plane;

–154 + 0.5 (δ – 5) dB(W/m²) in any 4 kHz for angles of arrival δ (degrees) between 5° and 25° above the horizontal plane;

–144 dB(W/m²) in any 4 kHz for angles of arrival between 25° and 90° above the horizontal plane.

PART 90 – PRIVATE LAND MOBILE RADIO SERVICES

5. The authority citation for part 90 continues to read as follows:

AUTHORITY: 47 U.S.C. 154(i), 161, 303(g), 303(r), 332(c)(7), 1401-1473.

6. Section 90.103 is amended by adding:

- a. Paragraph (a)(4);
- b. An entry to the table in paragraph (b), under the center heading “Megahertz” in numerical order, for “5650 to 5925”; and
- c. Paragraph (c)(31).

The additions read as follows:

§ 90.103 Radiolocation Service.

* * * * *

(a) * * *

(4) An operator or manufacturer of commercial spacecraft or spacecraft components; a parent corporation or its subsidiary if either corporation is an operator or manufacturer of spacecraft or spacecraft components; or an educational institution or a person primarily engaged in the design, development, modification, and flight test evaluation of spacecraft or spacecraft components.

(b) * * *

RADIOLOCATION SERVICE FREQUENCY TABLE

Frequency or band	Class of station(s)	Limitation
* * *	* *	* *
Megahertz		
* * *	* *	* *
5650 to 5925	Radiolocation land or mobile	31
* * *	* *	* *

* * * * *

(c) * * *

(31) This frequency band is shared on a co-primary basis to Government Radiolocation Service. The use of commercial space launch licenses in the 5650-5925 MHz band is restricted to launch vehicle tracking operations with signals originating from the launch vehicle

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[FR Doc. 2021-11063 Filed: 6/9/2021 8:45 am; Publication Date: 6/10/2021]